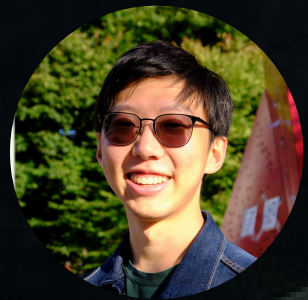


Where Can / Park?

Understanding Human Perspectives and Scalably Detecting Disability Parking



**Jared
Hwang**
UW CSE



**Chu
Li**
UW CSE



**Hanbyul
Kang**
UW CSE



**Maryam
Hosseini**
UC Berkeley
City and Regional
Planning



**Jon E.
Froehlich**
UW CSE

I am parked like this
because the wheelchair
parking spots were full, and
if anyone parks within
6½ feet of my car door
I can't get me & my wheelchair
into my car

Americans with
Disabilities Act (ADA)

4 - 8%

No compliance verification measures



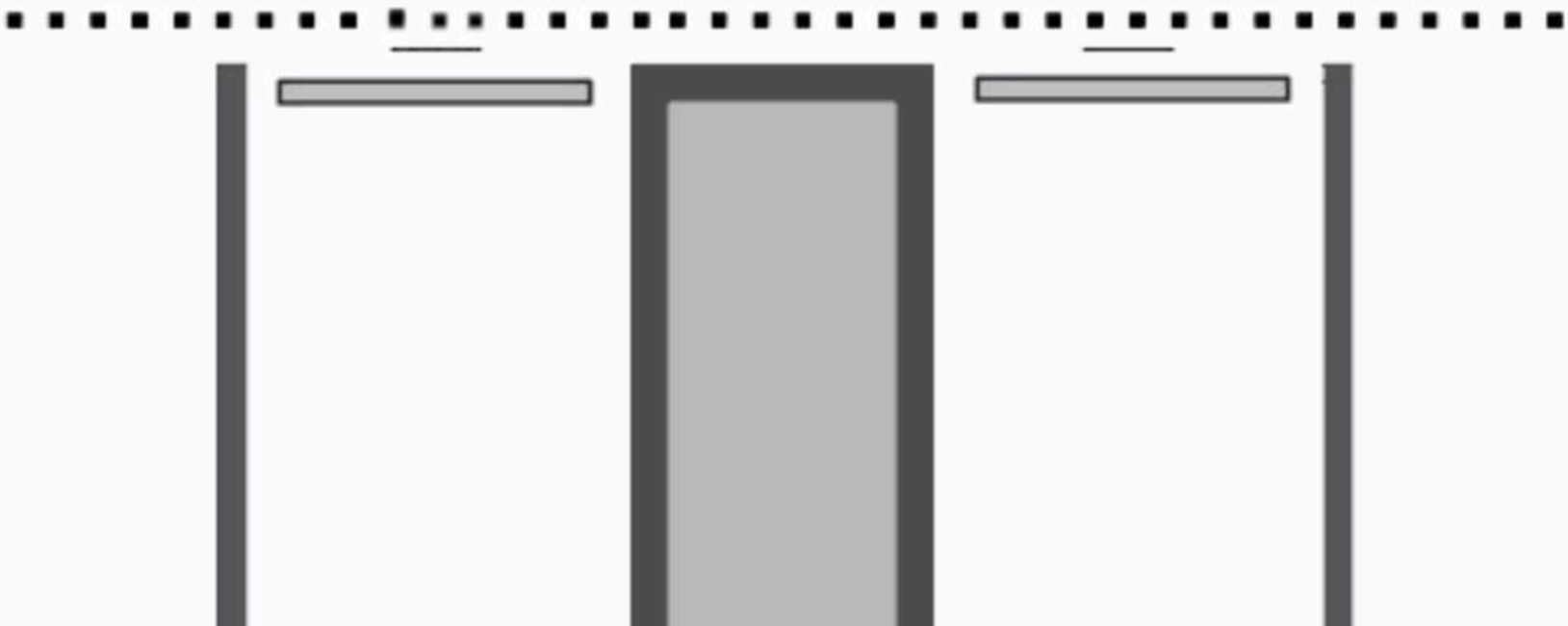
Two accessible parking spaces can share an access aisle with the access aisle between the two parking spaces (except in angled parking).

An access aisle can be placed on either side of the parking space (except in angled parking where it must be located on the passenger side of the parking space).

No large-scale study of disability parking in the US

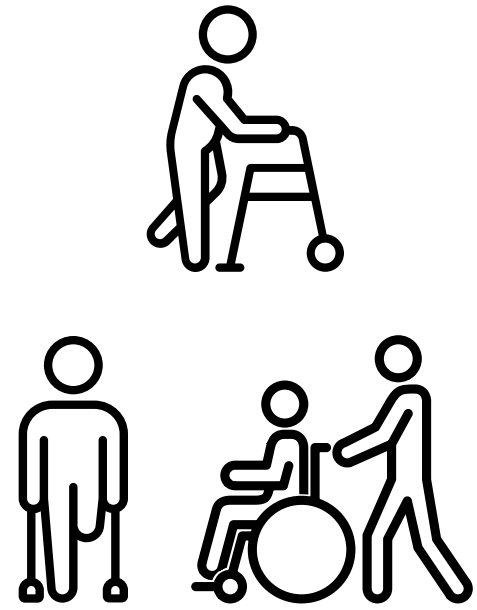
- ✓ Have an access aisle at least 60 inches wide
- ✓ Have no more than a 1.48 (2.08%) slope in all directions
- ✓ Have a minimum 8-foot clear width

Little work understanding *how* people use disability parking



Needfinding

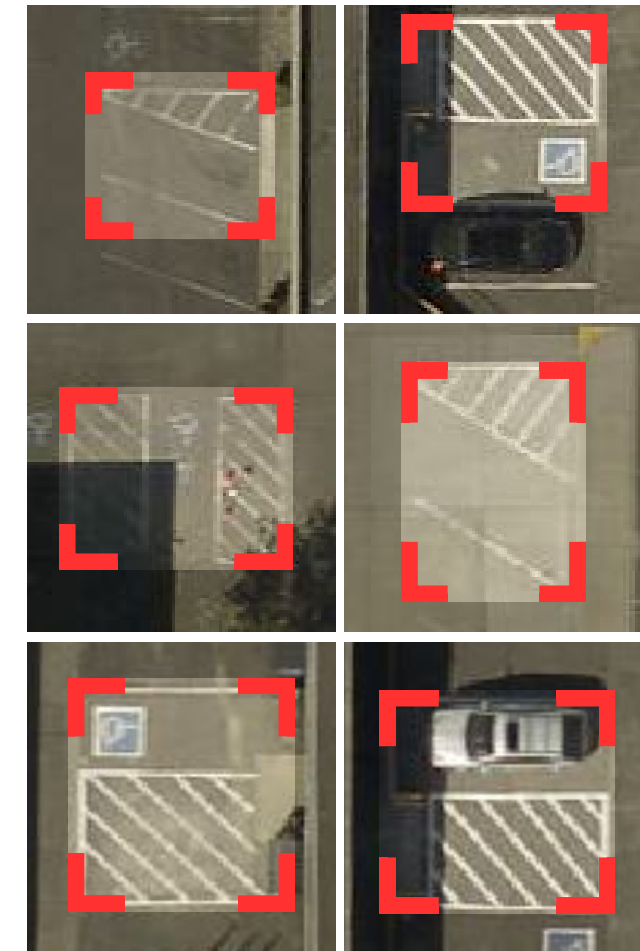
PwD Interviews
(N=11)



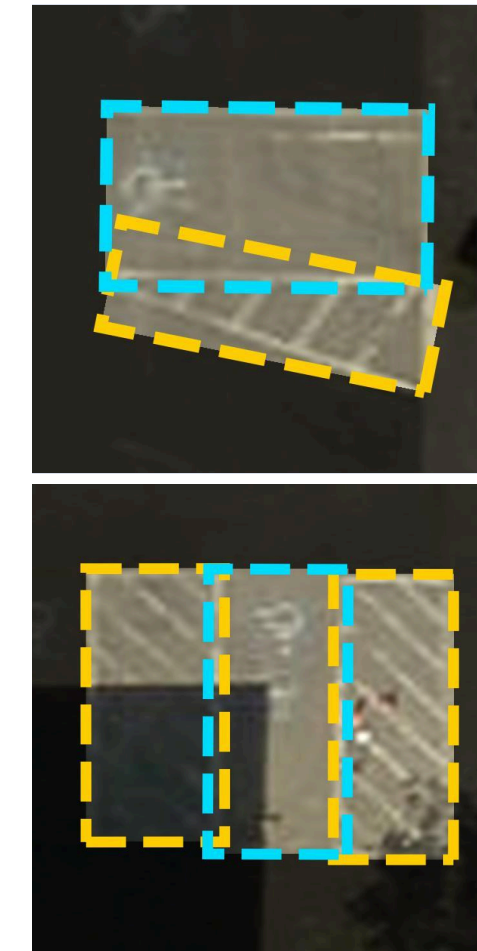
Orthorectified Tiles



Object Detection



Oriented
Bounding Boxes

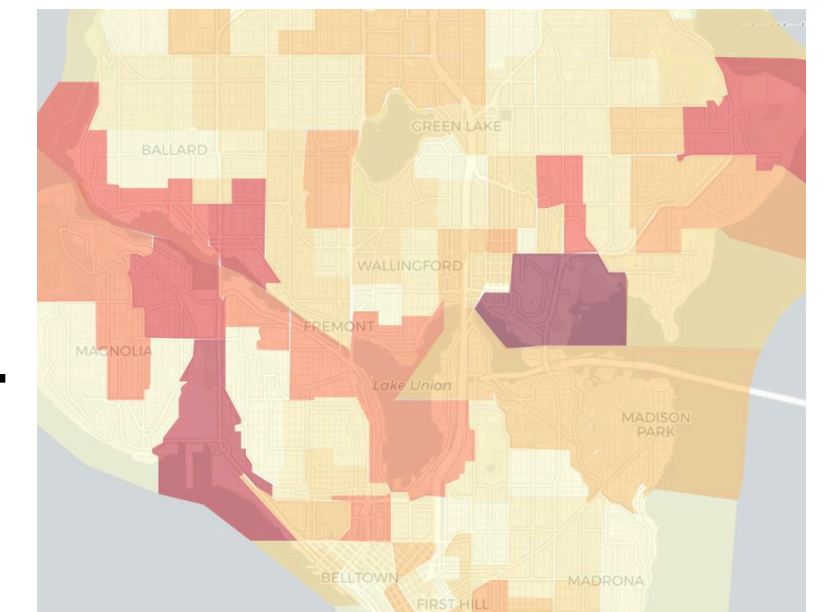


Completed Detections

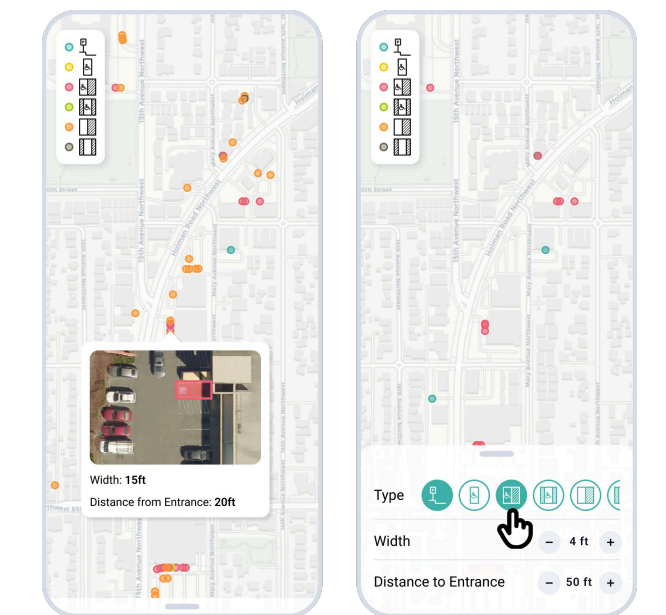


class: **'dp_one_aisle'**
width: **15ft**
lat: **47.62**
long: **-122.34**

New Applications



Disability Parking Analytics



Disability Parking App

Interview Study

*How do PwDs use
disability parking?*

Dataset & Pipeline Development

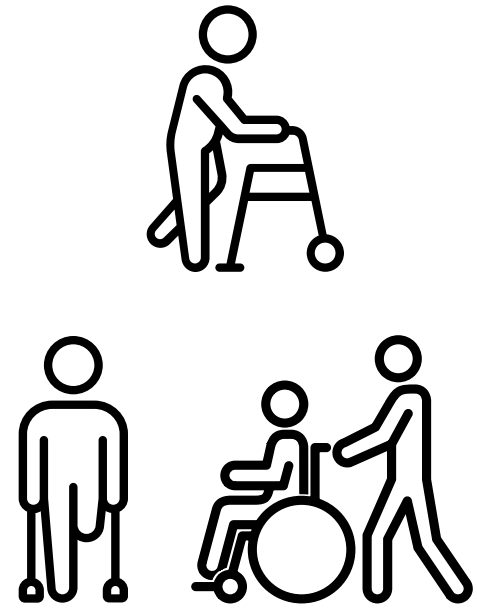
*How well can CV models locate and characterize
disability parking from aerial imagery?*

New Applications

*How could our CV model be used
to build useful technology tools?*

Needfinding

PwD Interviews
(N=11)



Algorithmic Pipeline and Dataset

Orthorectified Tiles



Object Detection



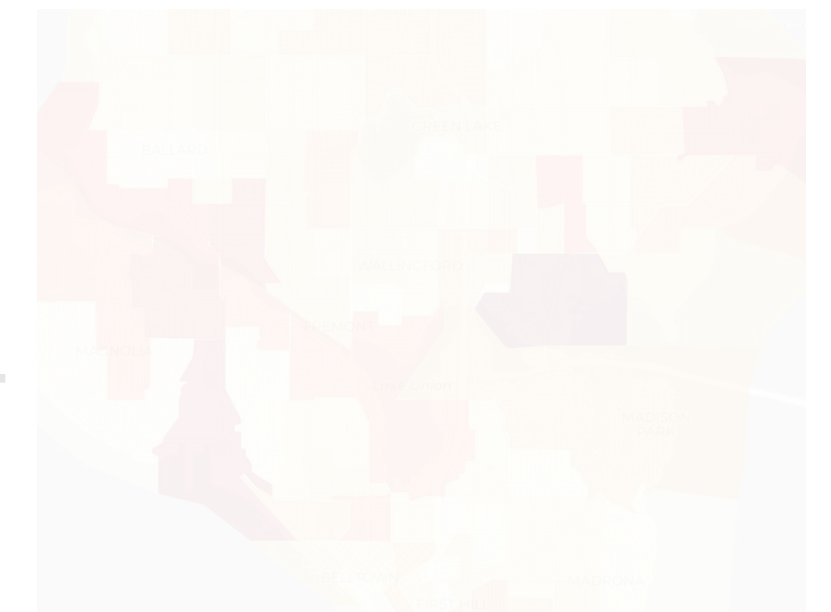
Oriented Bounding Boxes



Completed Detections



New Applications



Disability Parking Analytics



Disability Parking App

Interview Study

How do PwDs use disability parking?

Dataset & Pipeline Development

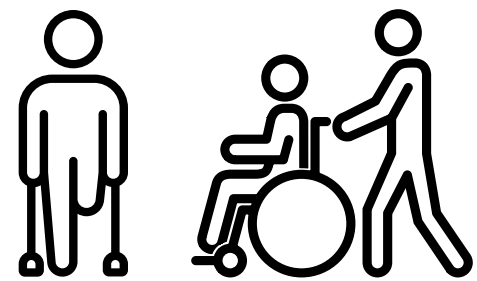
How well can CV models locate and characterize disability parking from aerial imagery?

New Applications

How could our CV model be used to build useful technology tools?

Needfinding

PwD Interviews
(N=11)



Recruitment:

- *11 Participants with disabilities*
- *Eligible for disability parking*

Interview:

- *Part 1: How does disability parking factor into transportation decisions?*
- *Part 2: What do participants like/dislike about disability parking?*
- *Part 3: Technology tools*

Interview Study

*How do PwDs use
disability parking?*

Disability parking needs

Individual burden and adaptation

Technology tools

Disability parking needs

“ If the car can fit in and I can get in and out of the car, that’s all I look for. ”

 P7

“ As long as I can use my equipment, I don’t mind going further, but other times without sidewalks and curb cuts, there’s been times where I couldn’t park anywhere. ”

 P9

“ Most are on the right side, why not the left? Doesn’t make any sense to me, except for if somebody’s in a manual chair. ”

 P4

Individual burden and adaptation

Technology tools

Disability parking needs

Individual burden and adaptation

“ There’s been quite a few times when I’ve had to either create my own space or illegally park in a bank that was closed. ”

 P2

“ I’ll park out over the white line... and then you come back and you can see people who got really annoyed, and it’s like, I’m sorry, I can’t help it. ”

 P3

“ I do math in my head about...how badly do I need to go to the store today? ”

 P11

Technology tools

Disability parking needs

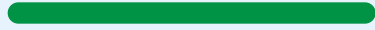
Individual burden and adaptation

Technology tools

“ I don’t necessarily know whether there’s a flight of stairs or the accessible ramp is that way... just having that extra information, it can’t not help ”

 P8

“ If you could say ‘All these are full; the next closest ADA spot is here,’ that would be pretty cool. ”

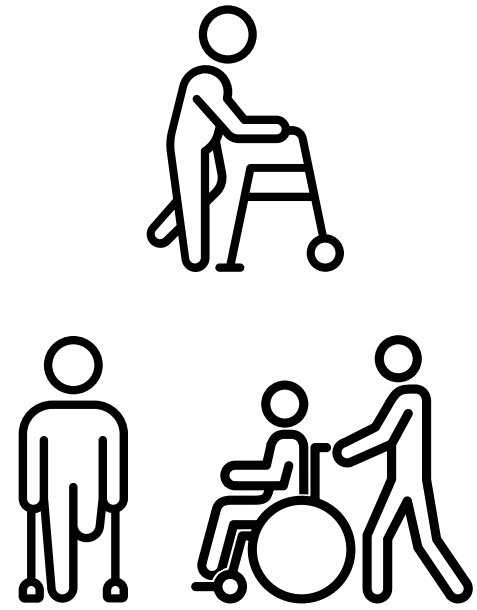
 P10

“ I don’t want somebody else’s computer program getting me the information that I want when I can just do it myself. ”

 P7

Needfinding

PwD Interviews
(N=11)



Algorithmic Pipeline and Dataset

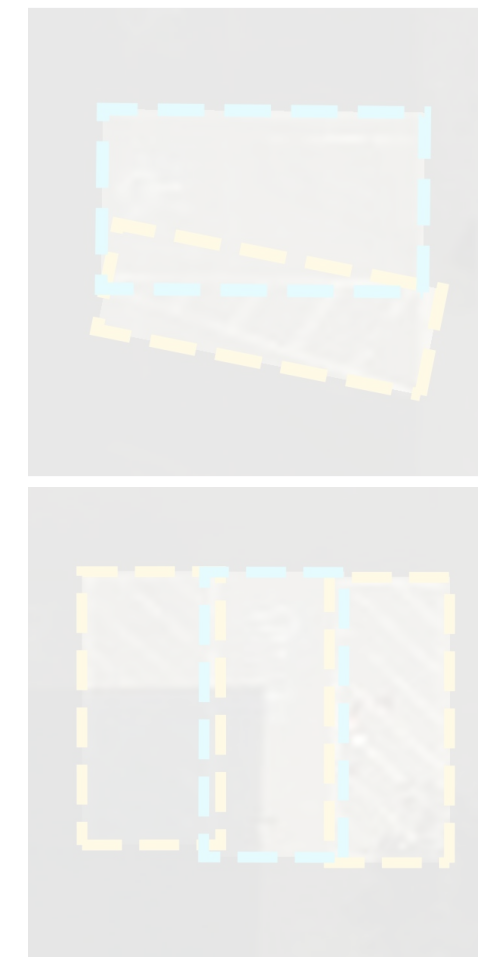
Orthorectified Tiles



Object Detection



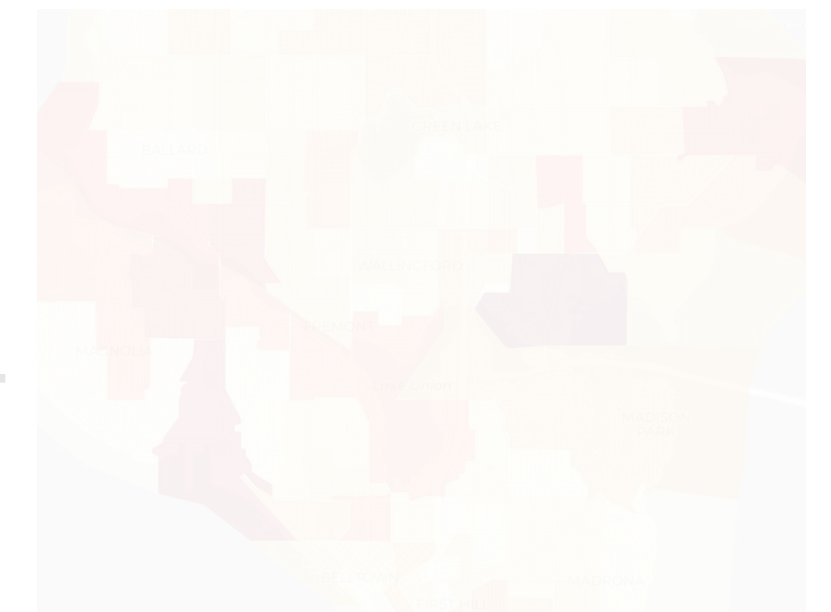
Oriented
Bounding Boxes



Completed Detections



New Applications



Disability Parking Analytics



Disability Parking App

Interview Study

*How do PwDs use
disability parking?*

Dataset & Pipeline Development

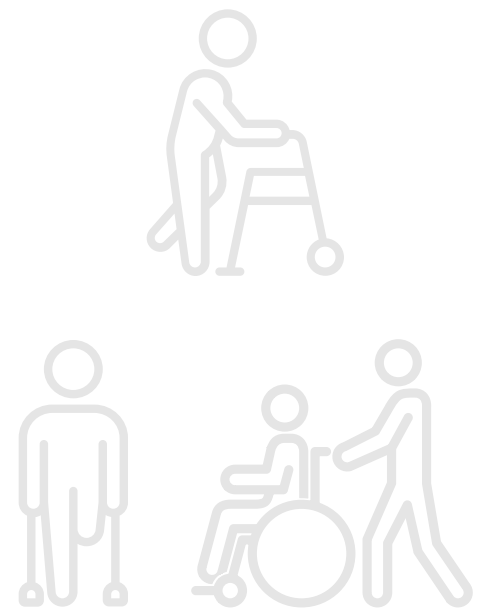
*How well can CV models locate and characterize
disability parking from aerial imagery?*

New Applications

*How could our CV model be used
to build useful technology tools?*

Needfinding

PwD Interviews
(N=11)

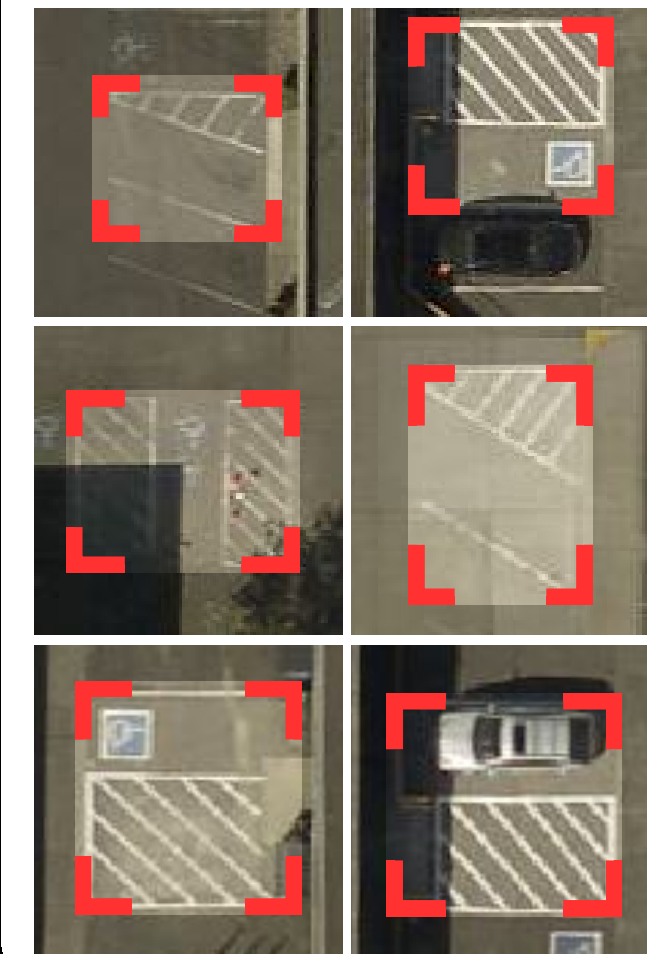


Algorithmic Pipeline and Dataset

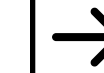
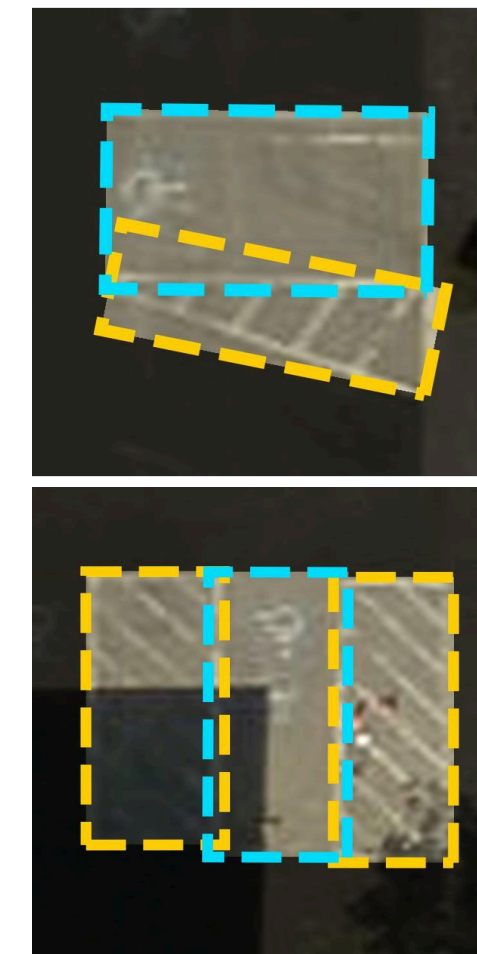
Orthorectified Tiles



 Object Detection



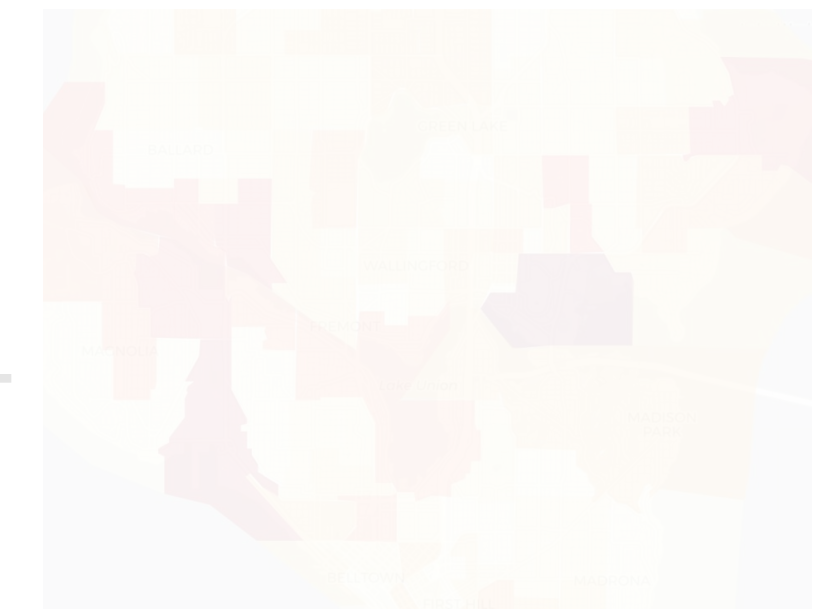
 Oriented Bounding Boxes



Completed Detections



New Applications



Disability Parking Analytics



Disability Parking App

Interview Study

*How do PwDs use
disability parking?*

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disability parking from aerial imagery?*

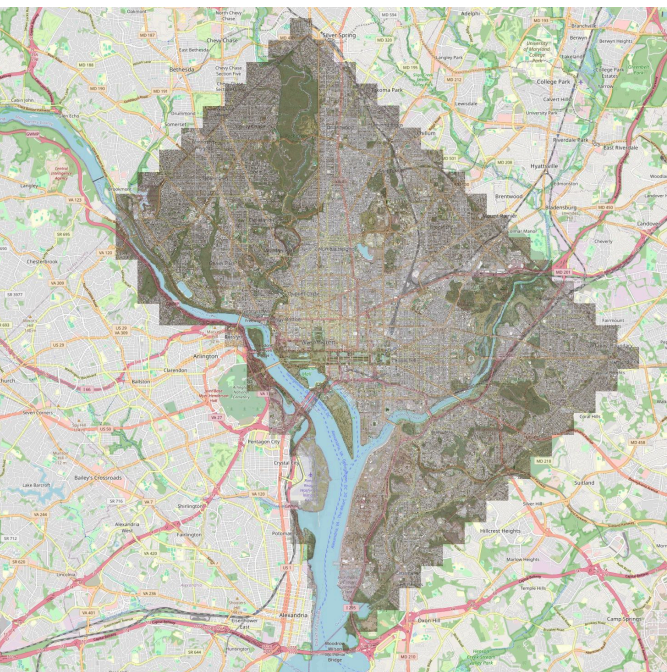
New Applications

*How could our CV model be used
to build useful technology tools?*

Data Sources



Seattle
2,790 images



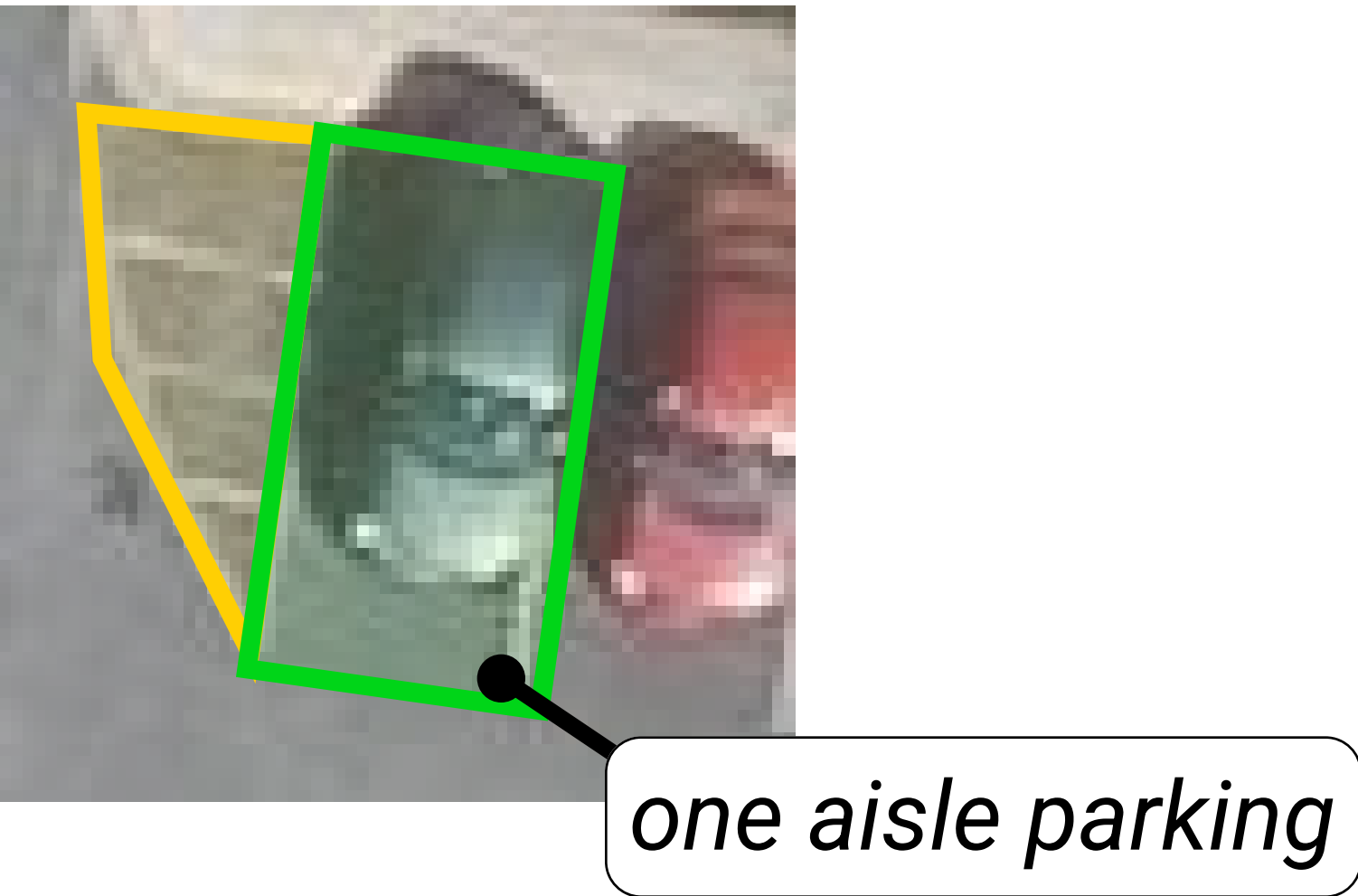
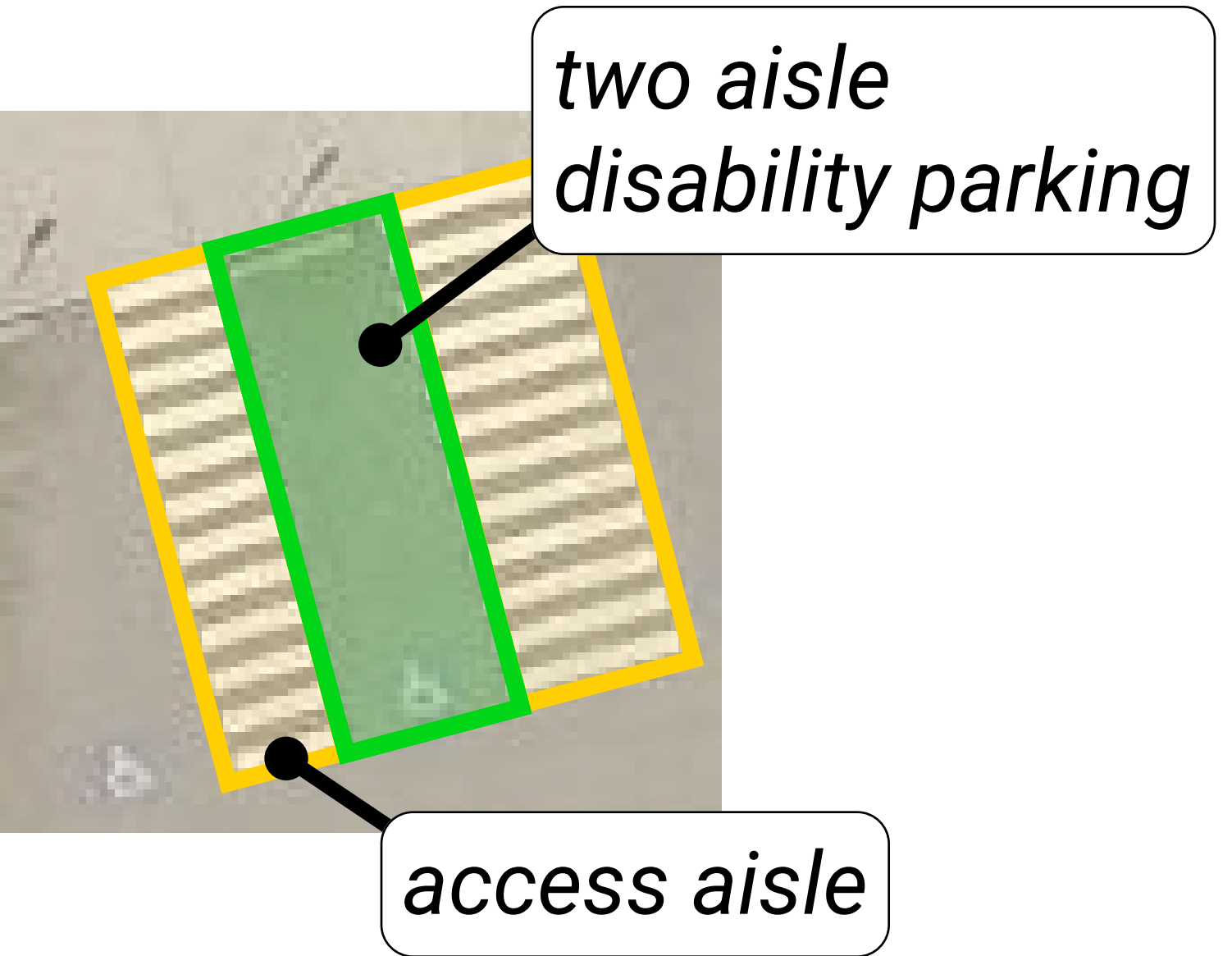
Washington D.C.
1,801 images



Spring Hill, TN
534 images

Total: 5,125 images

Labeling



Class Statistics

Class	Quantity
access aisle	4,693
curbside	36
no aisle	300
one aisle	6,214
two aisles	519
Total	11,762

**Dataset released
open-source!**

Algorithmic Pipeline and Dataset

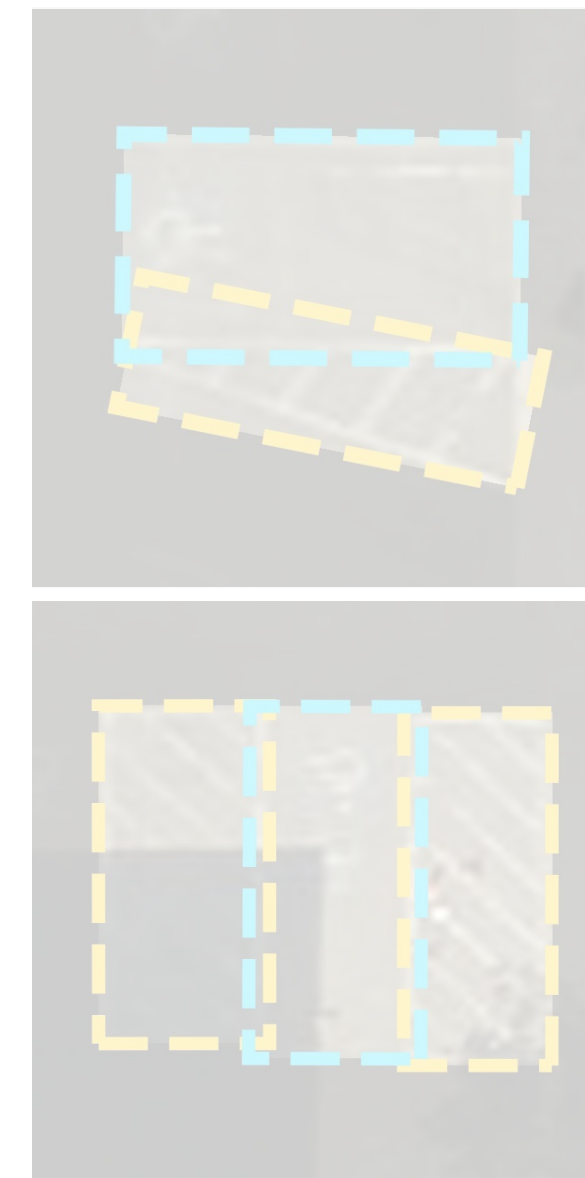
Orthorectified Tiles



Object Detection



Oriented Bounding Boxes



Completed Detections

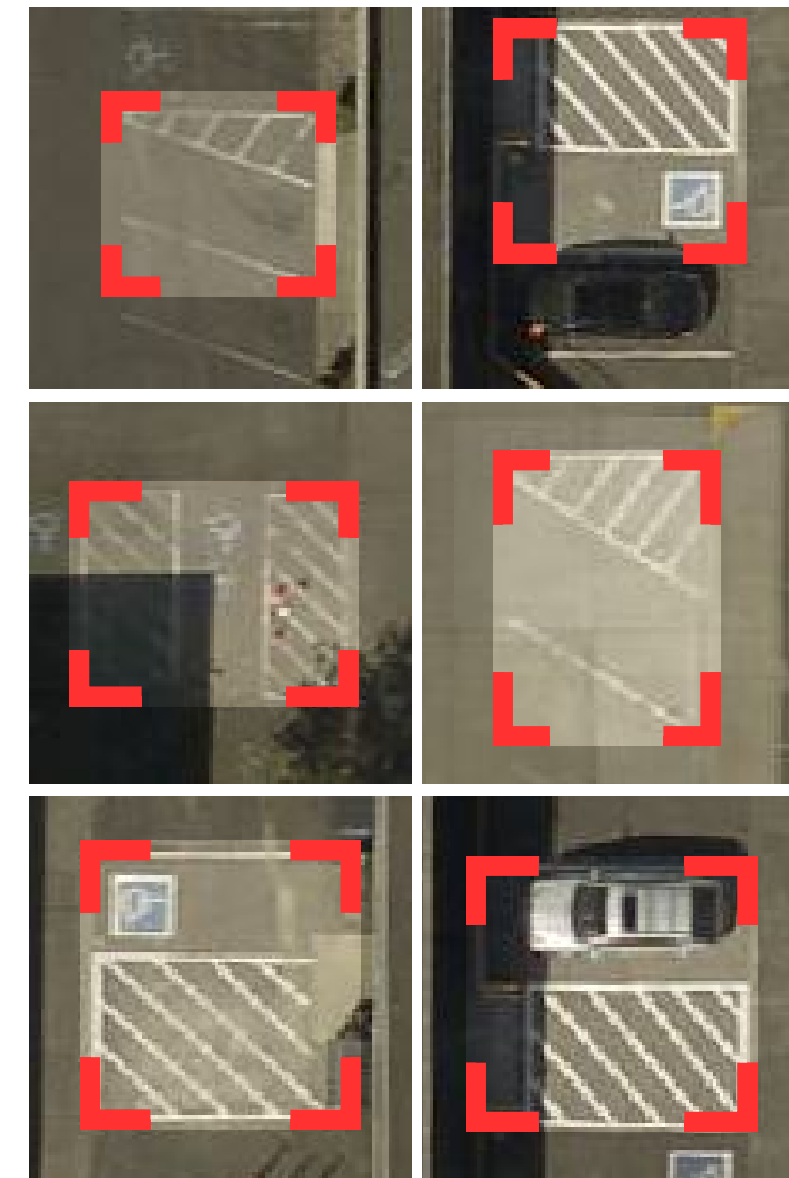


Algorithmic Pipeline and Dataset

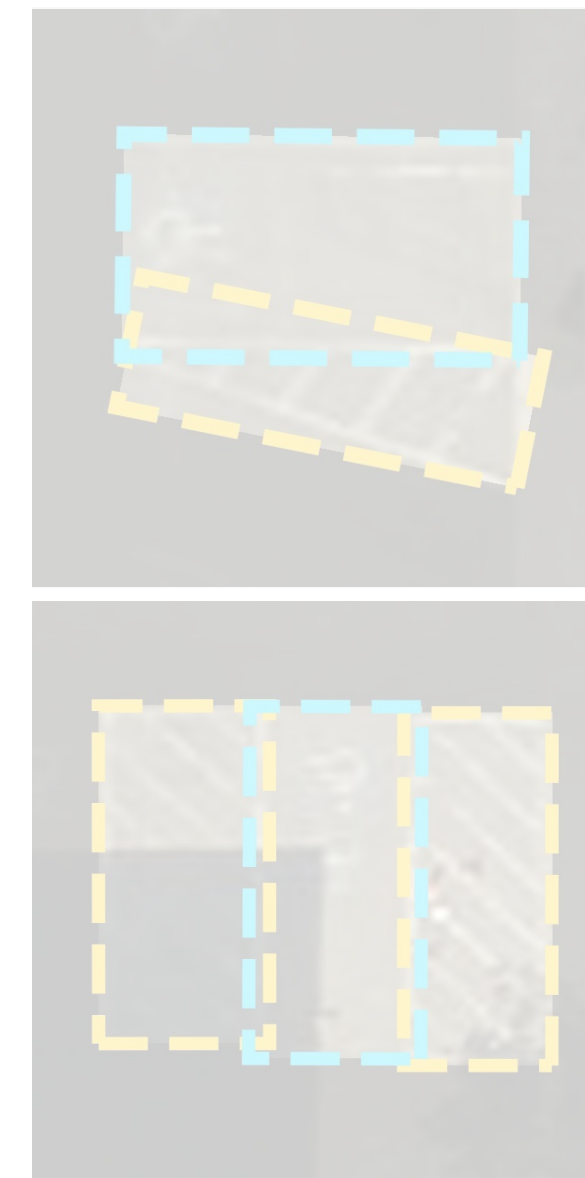
Orthorectified Tiles



 Object Detection



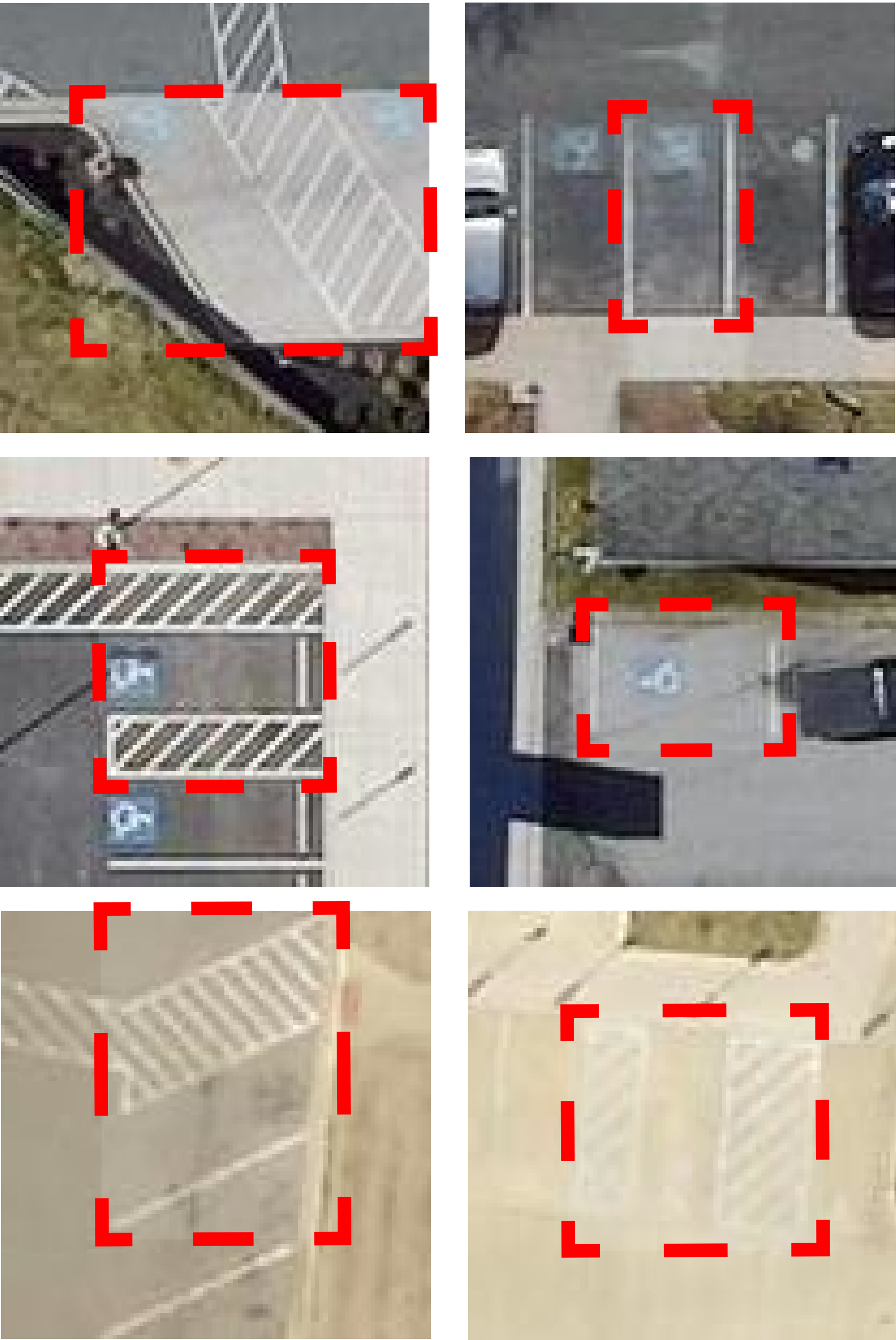
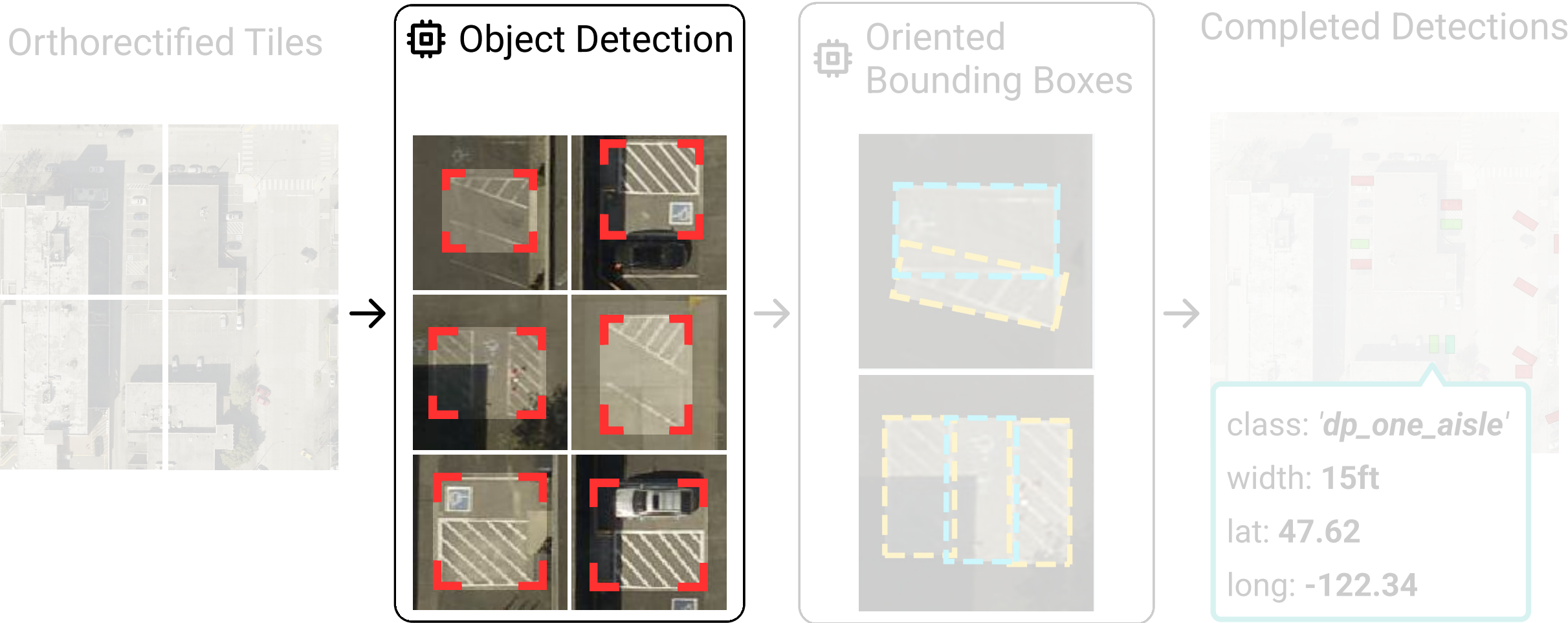
 Oriented Bounding Boxes



Completed Detections

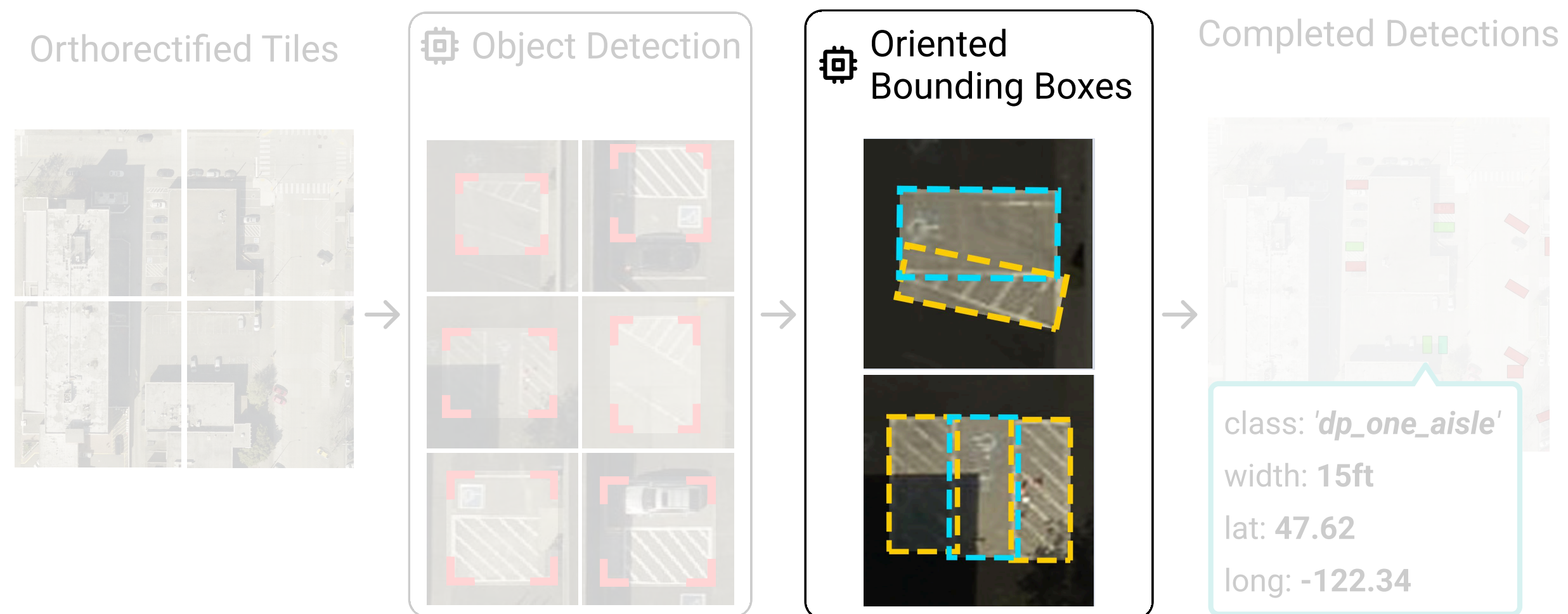


Algorithmic Pipeline and Dataset



Object Detection

- Co-DETR

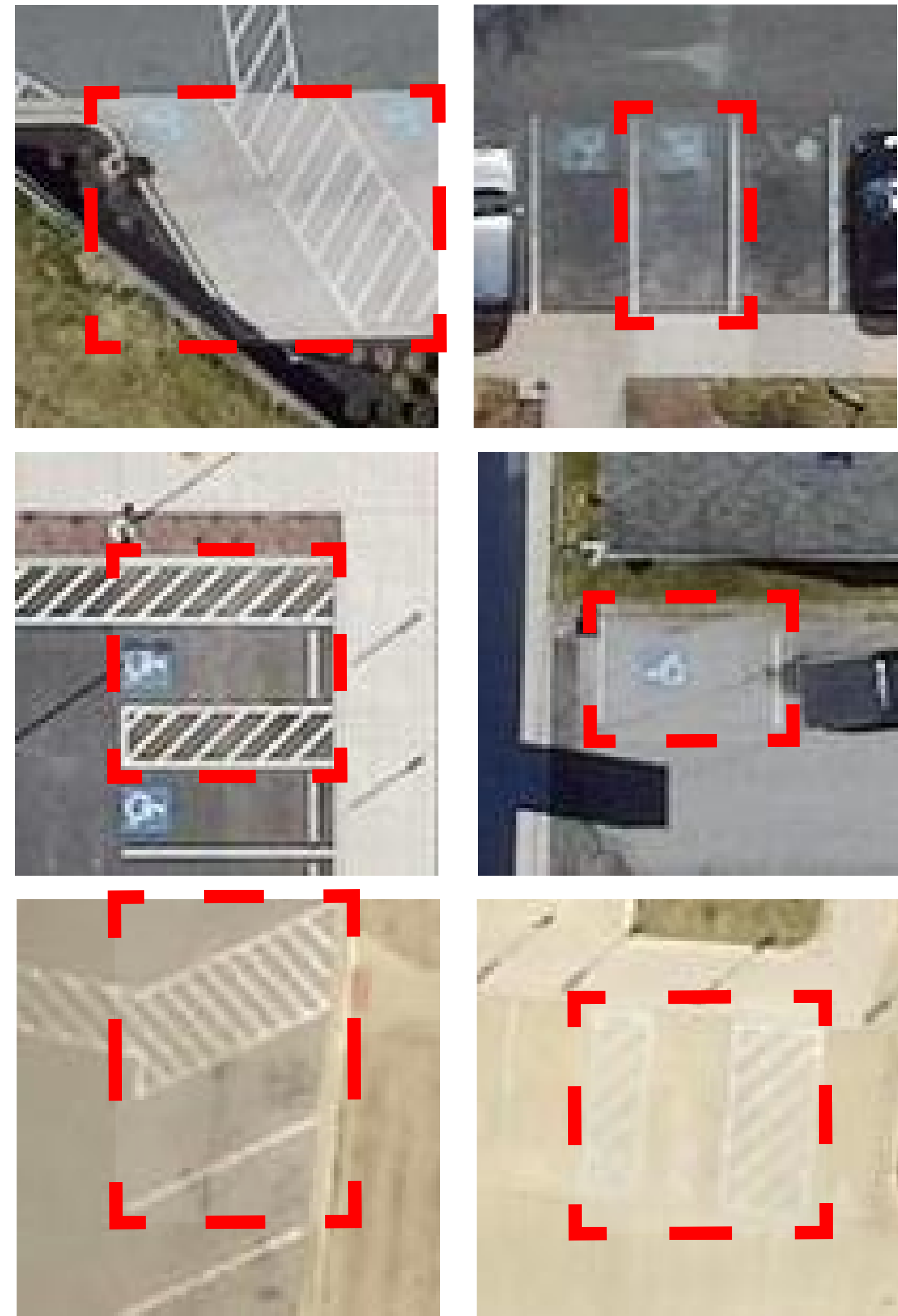


Object Detection

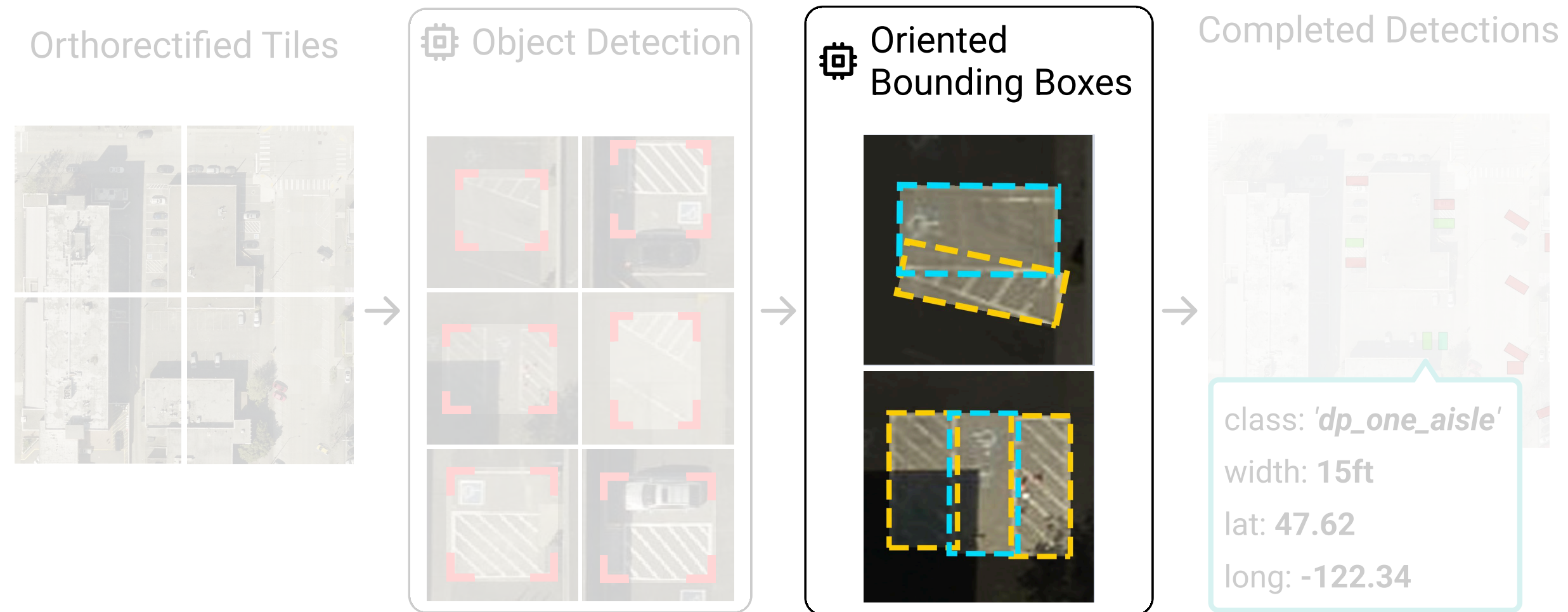
- Co-DETR

Generating Oriented Bounding Boxes

- YOLOv11x OBB



Algorithmic Pipeline and Dataset

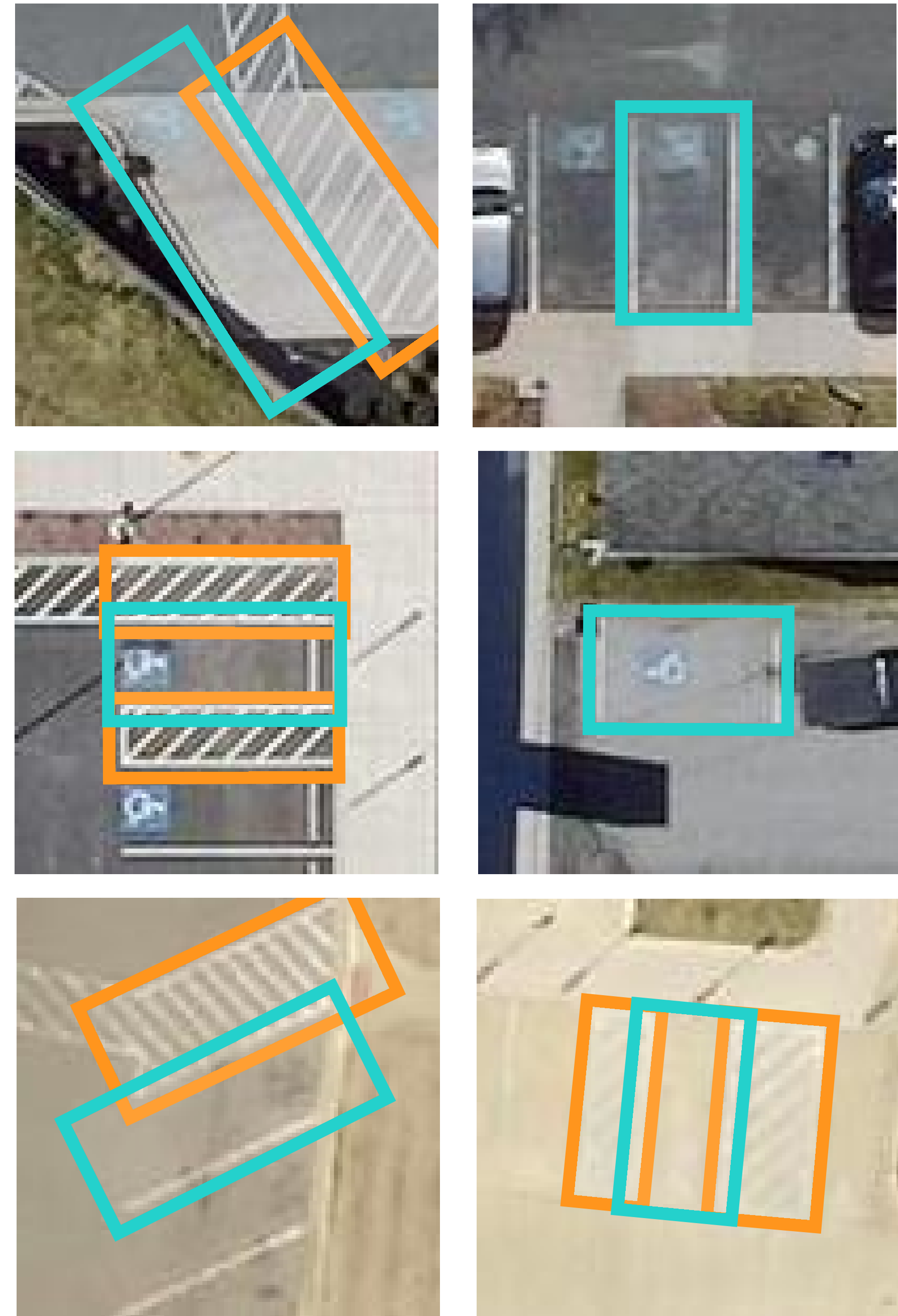


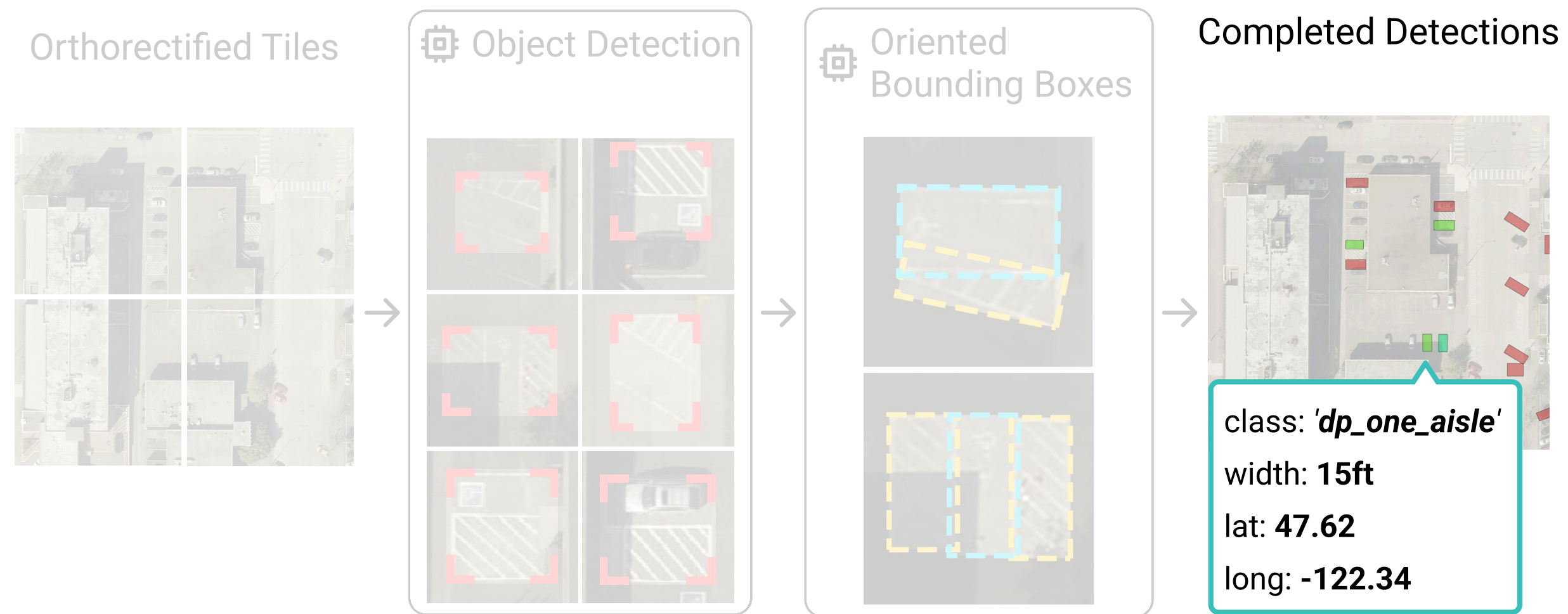
Object Detection

- Co-DETR

Generating Oriented Bounding Boxes

- YOLOv11x OBB





Object Detection

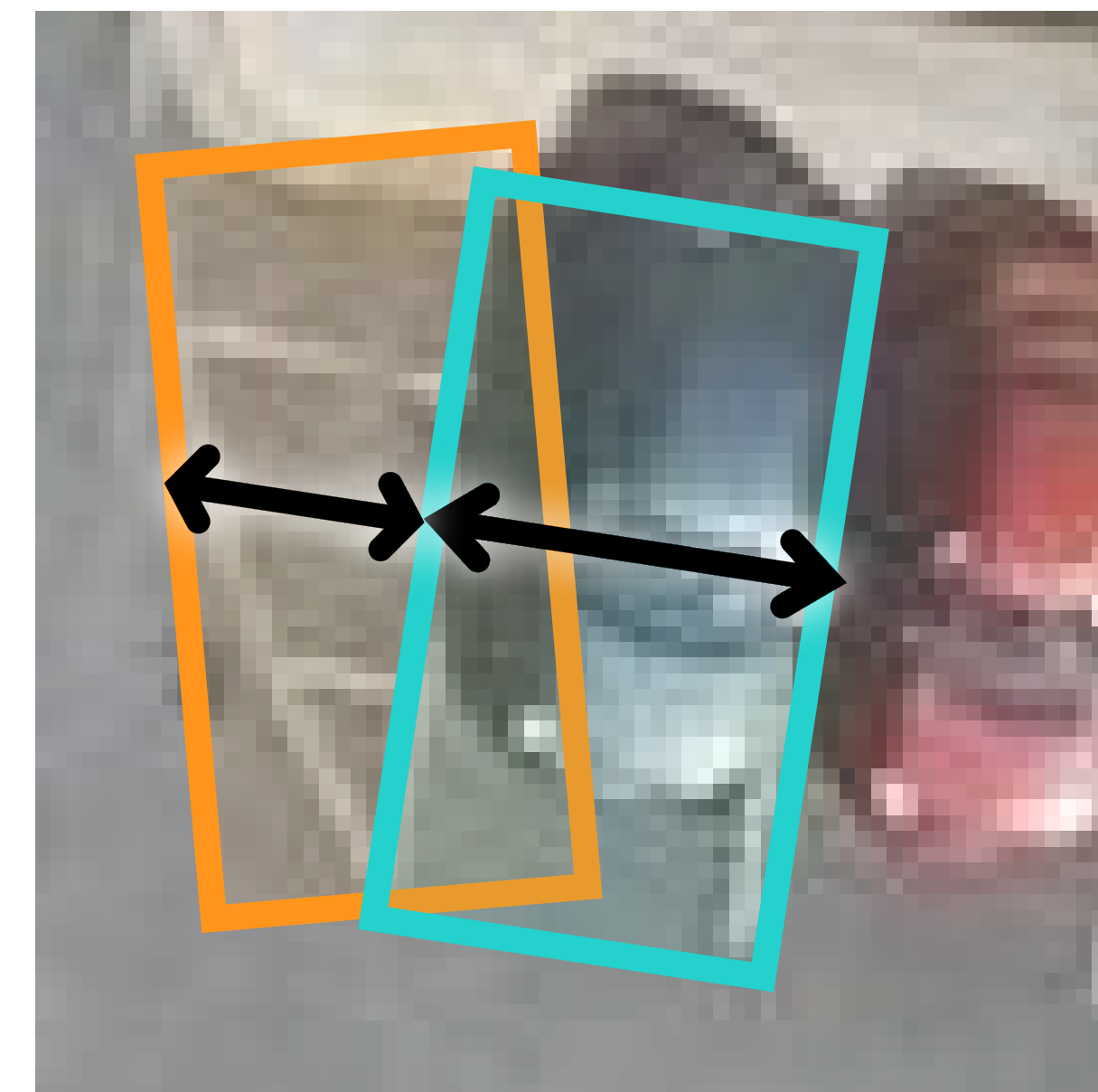
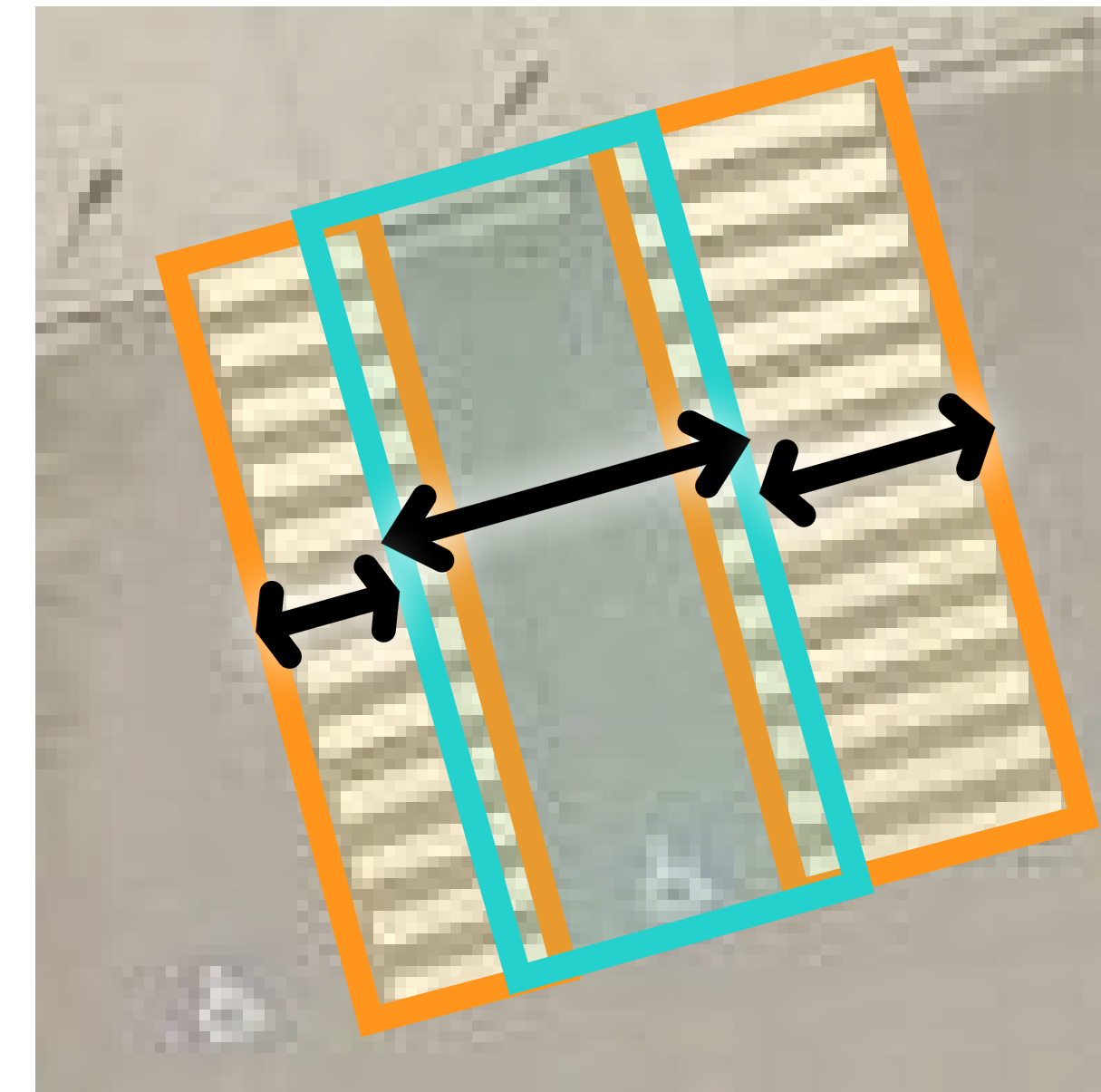
- Co-DETR

Generating Oriented Bounding Boxes

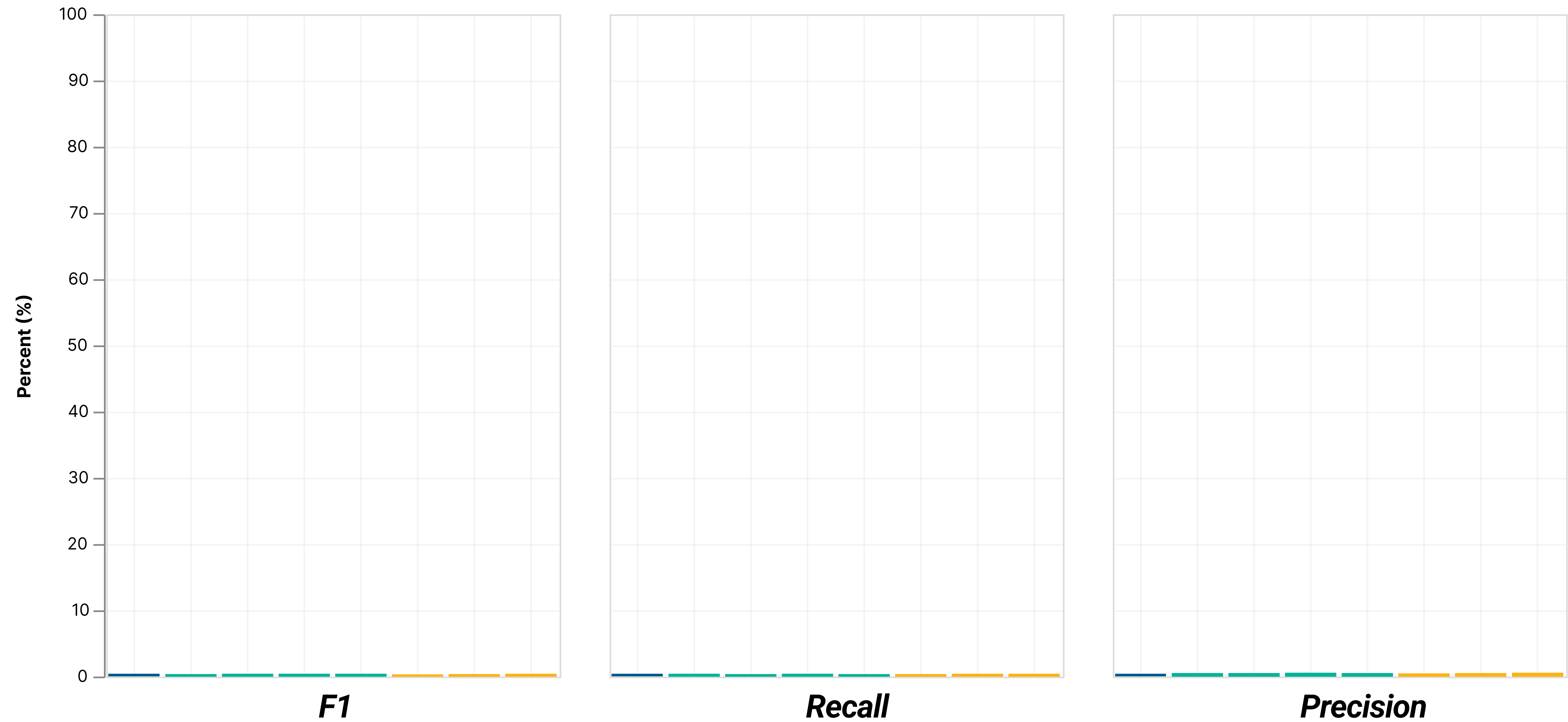
- YOLOv11x OBB

Parking Space Characterization

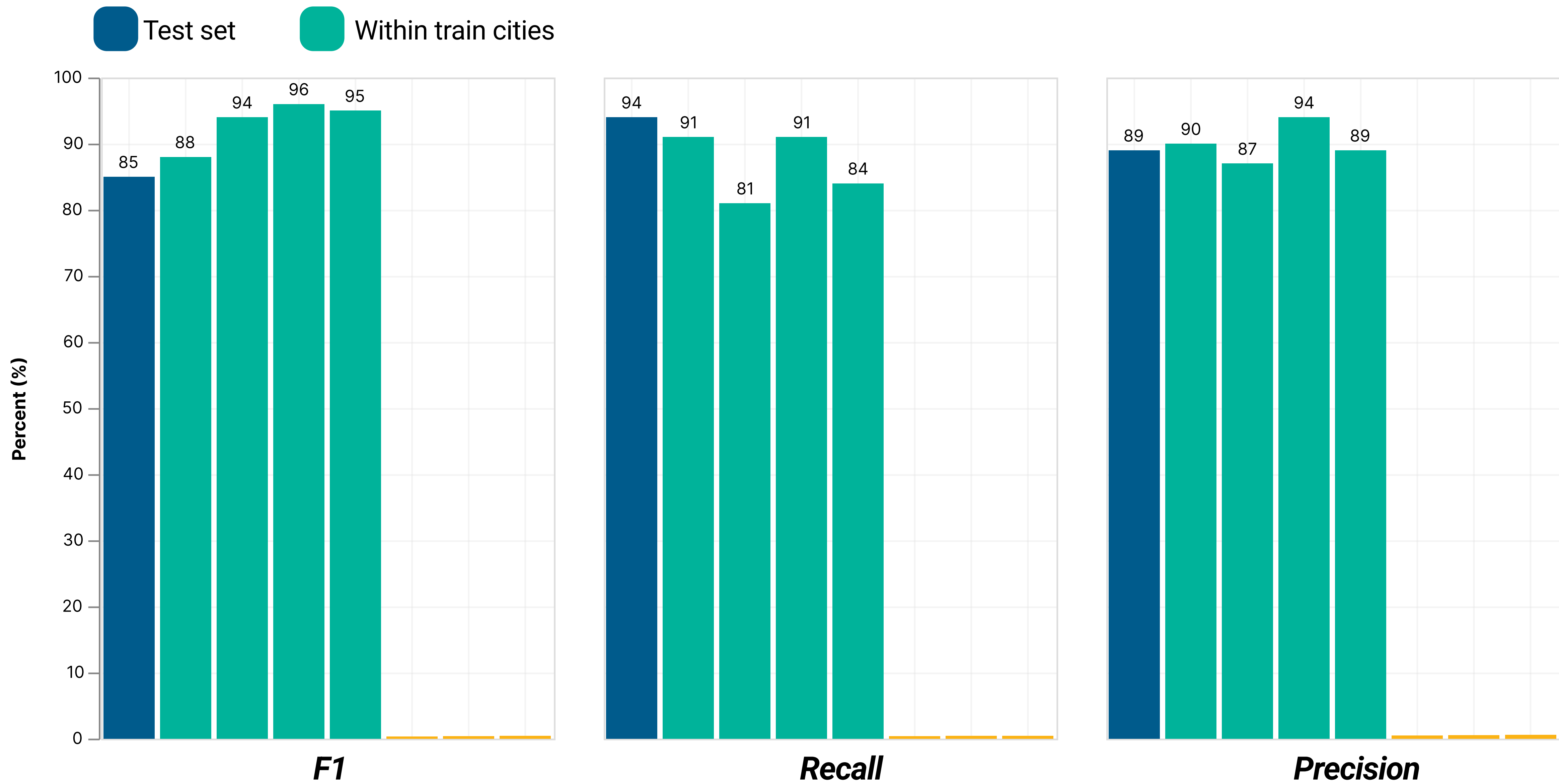
- Calculate width from detected OBBs



Object Detection Performance



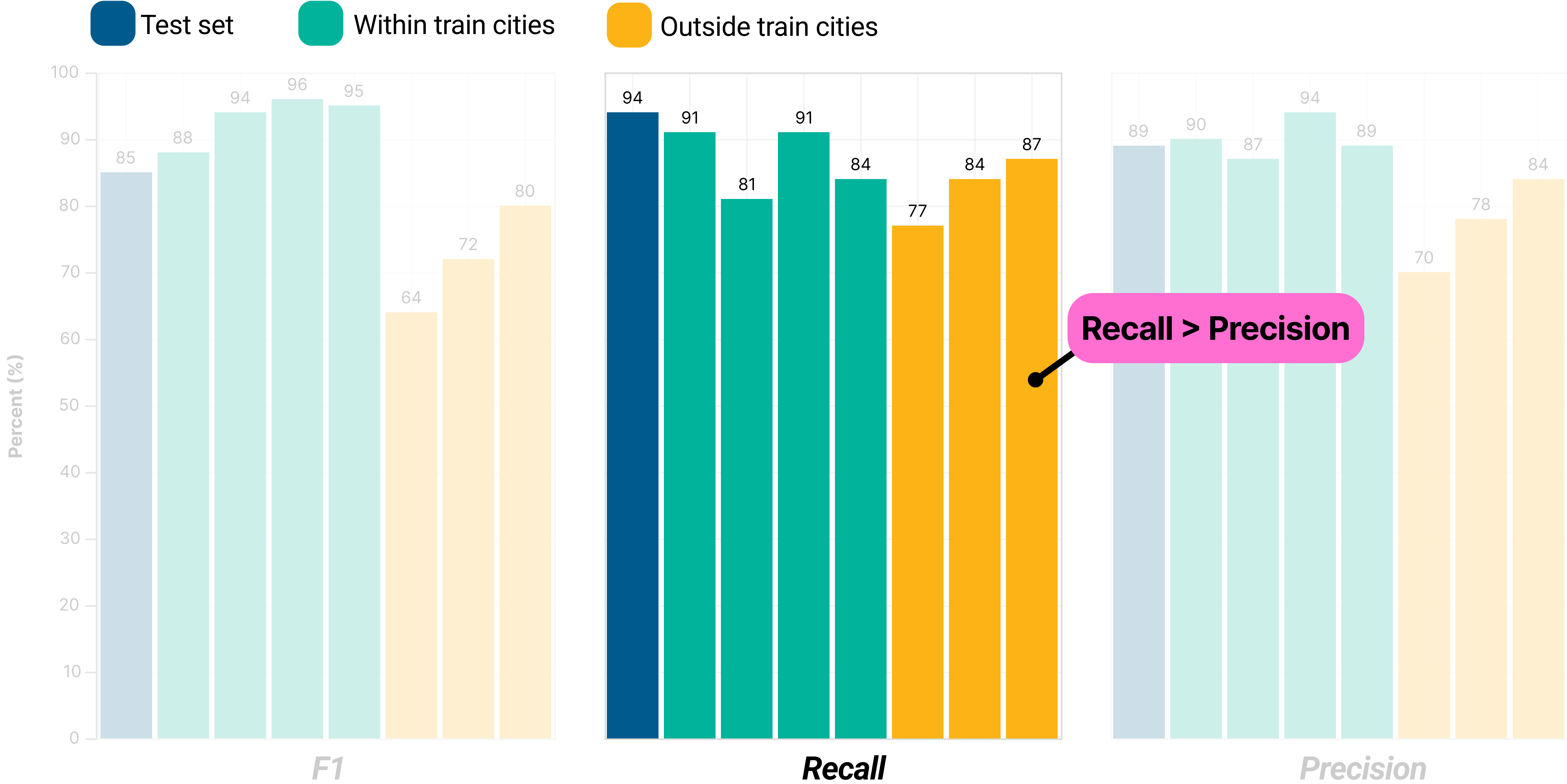
Object Detection Performance



Object Detection Performance

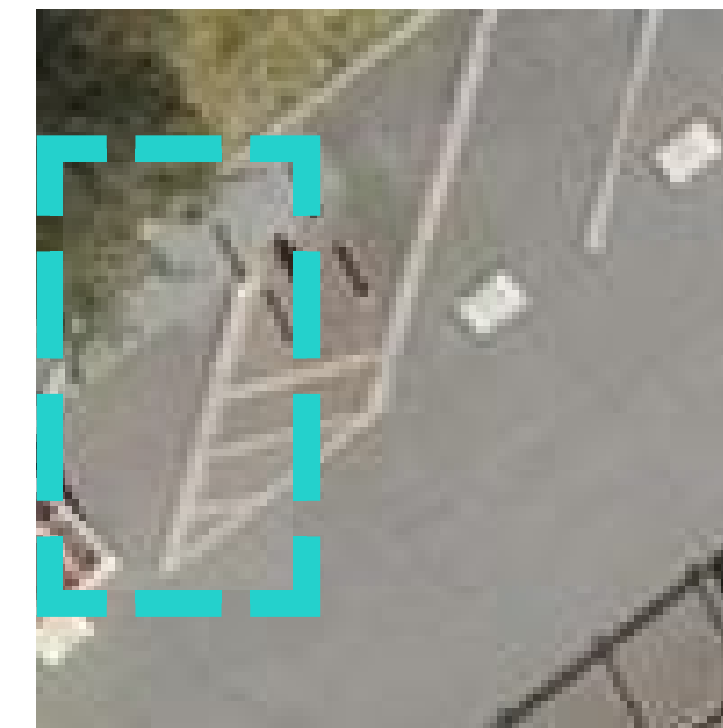
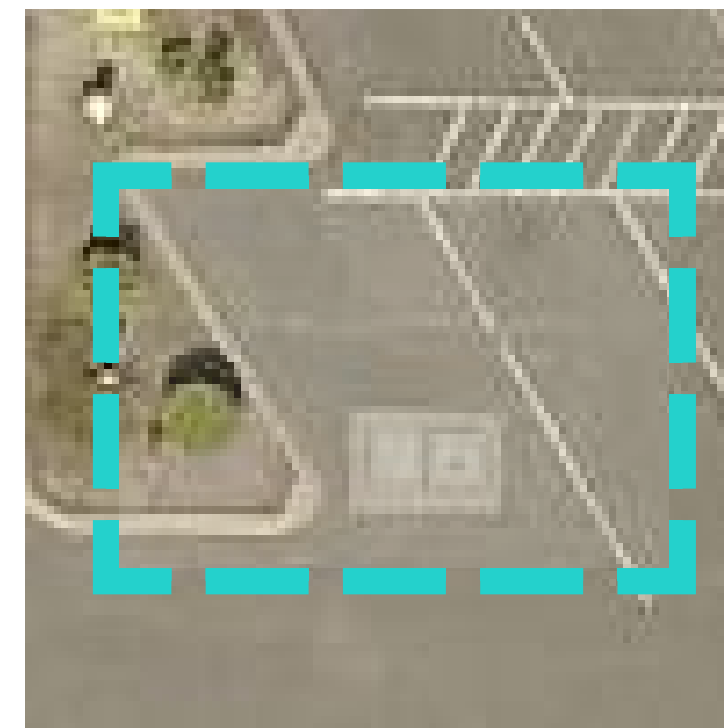
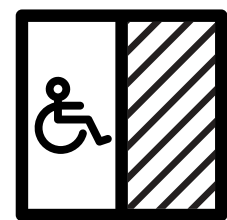


Object Detection Performance

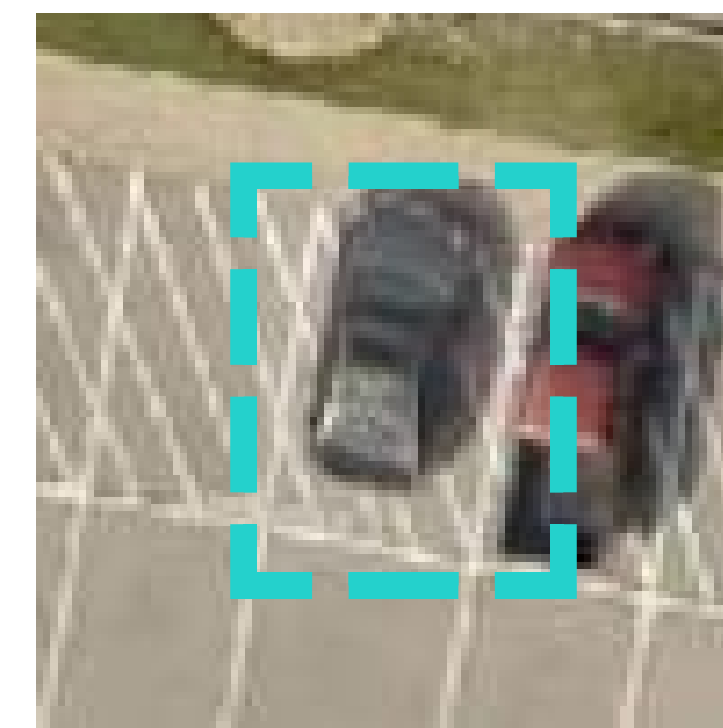
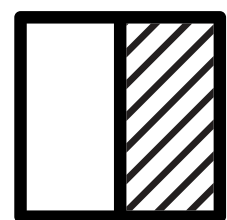


False Positives

disability parking
with one aisle

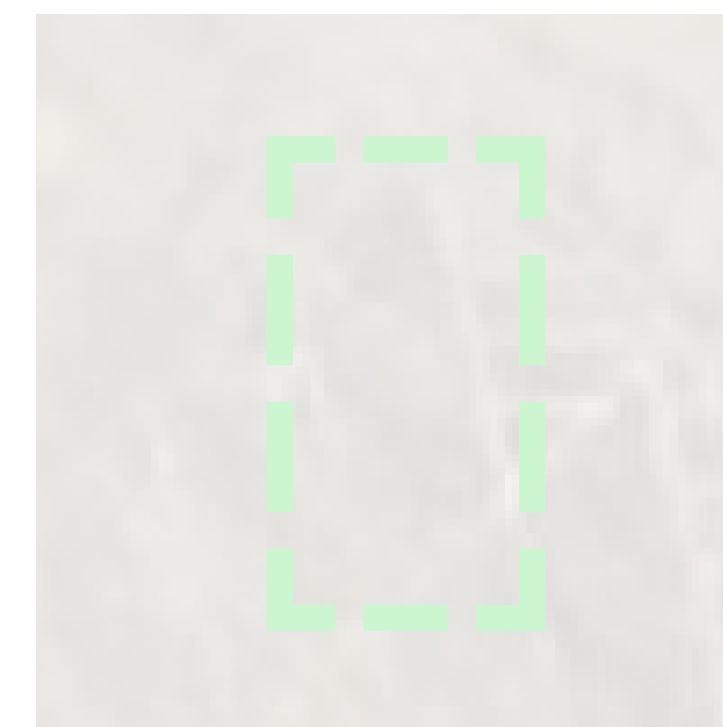
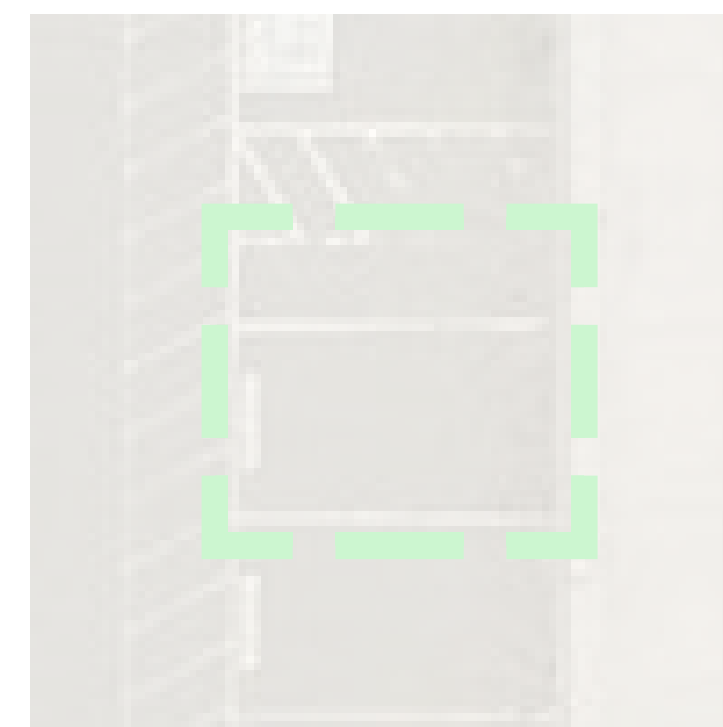
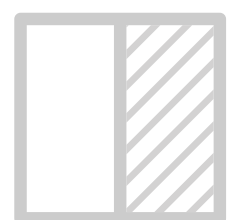


parking with
one aisle



False Negatives

parking with
one aisle

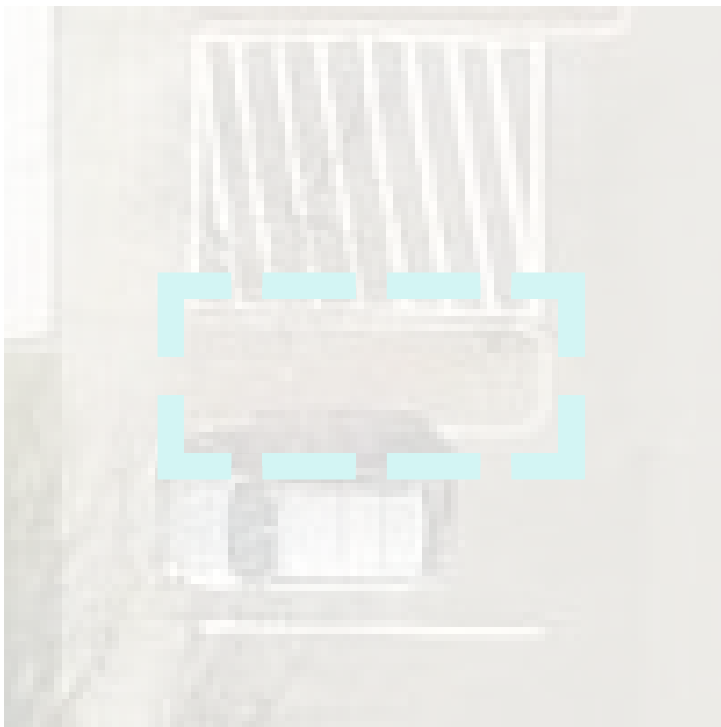
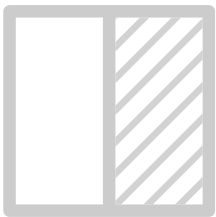


False
Positives

disability parking
with one aisle

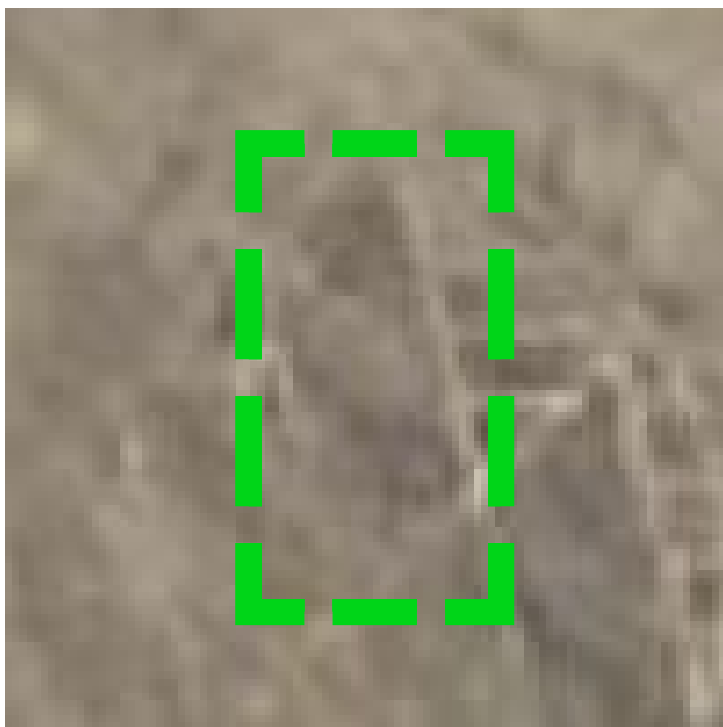
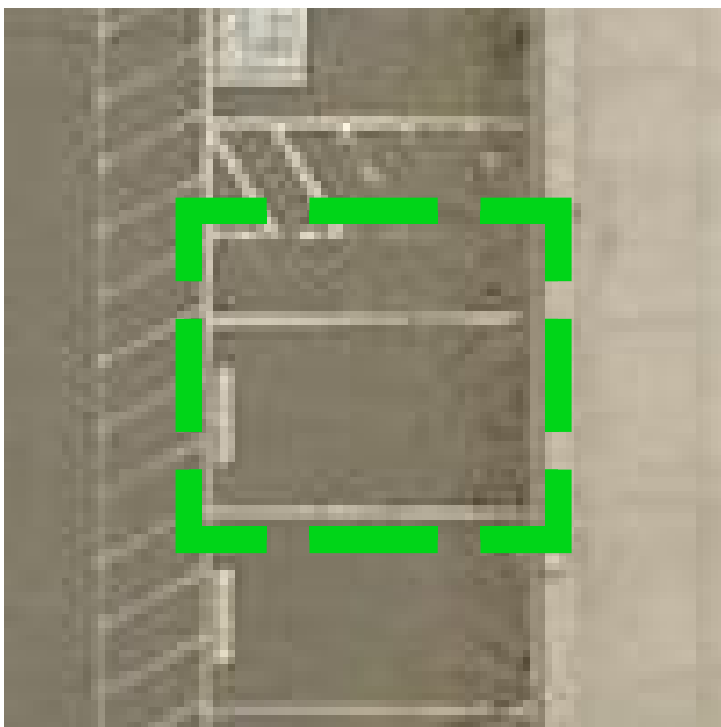
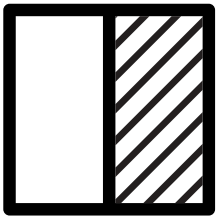


parking with
one aisle

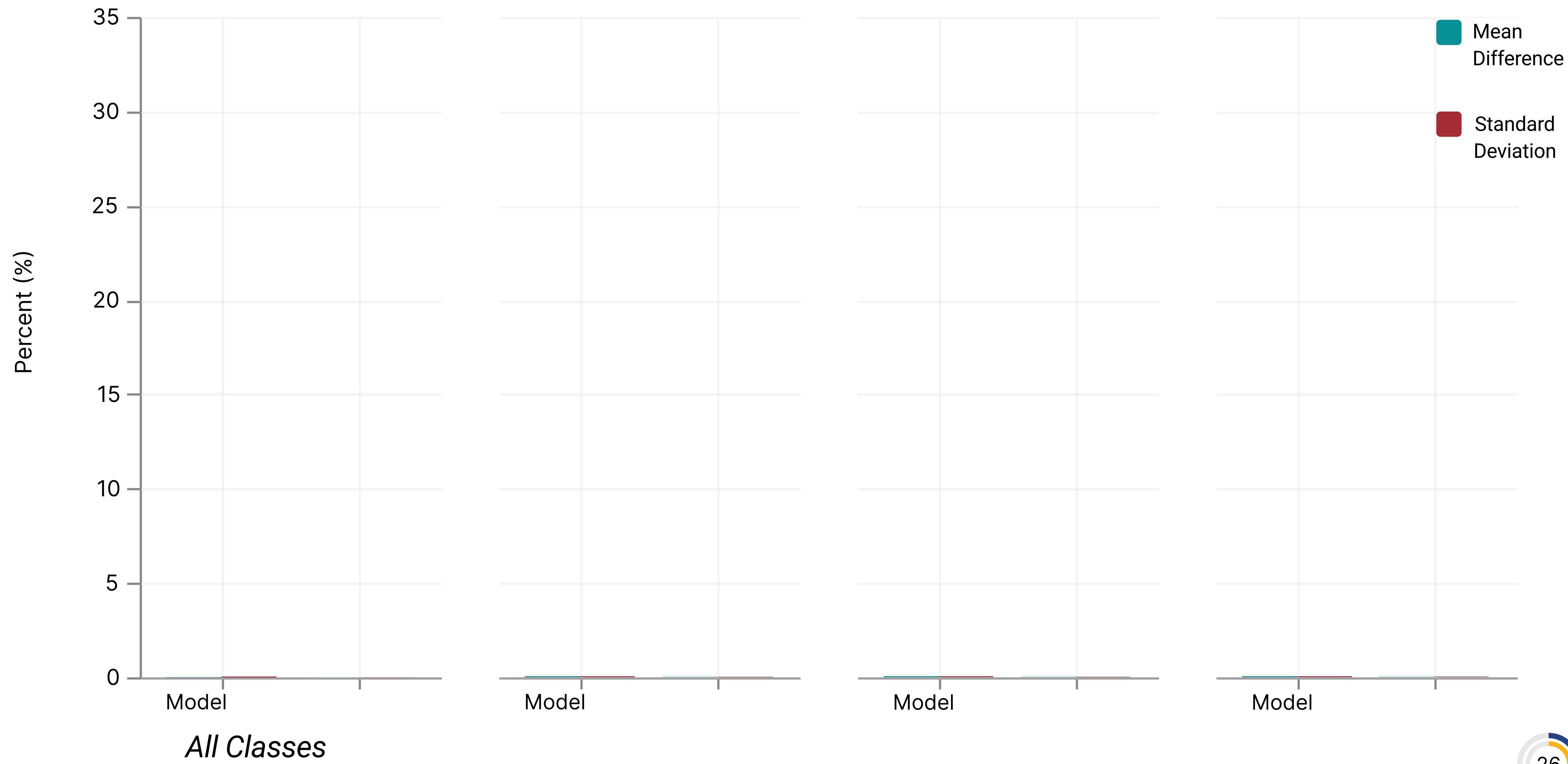


False
Negatives

parking with
one aisle

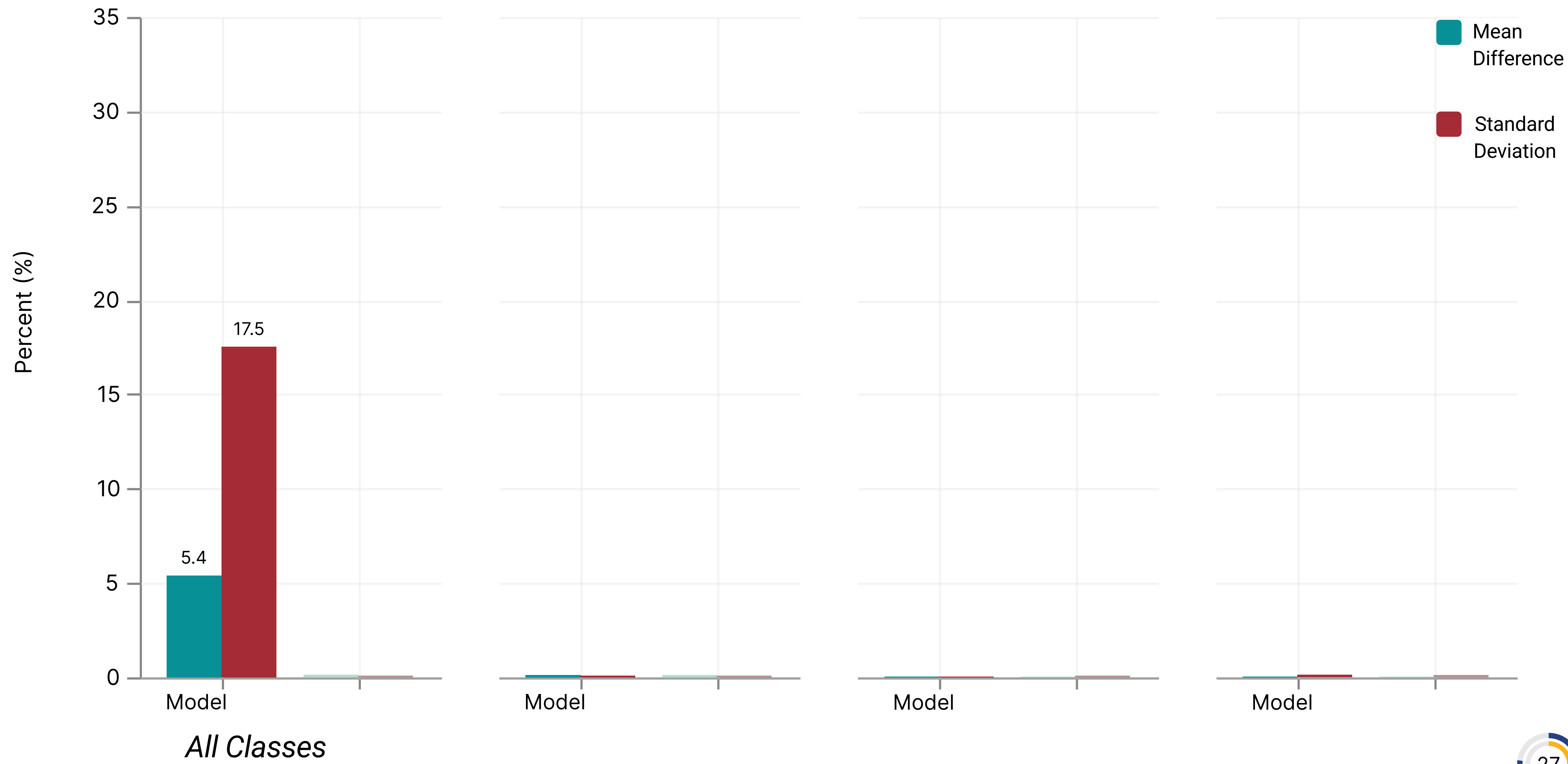


Width Characterization Performance

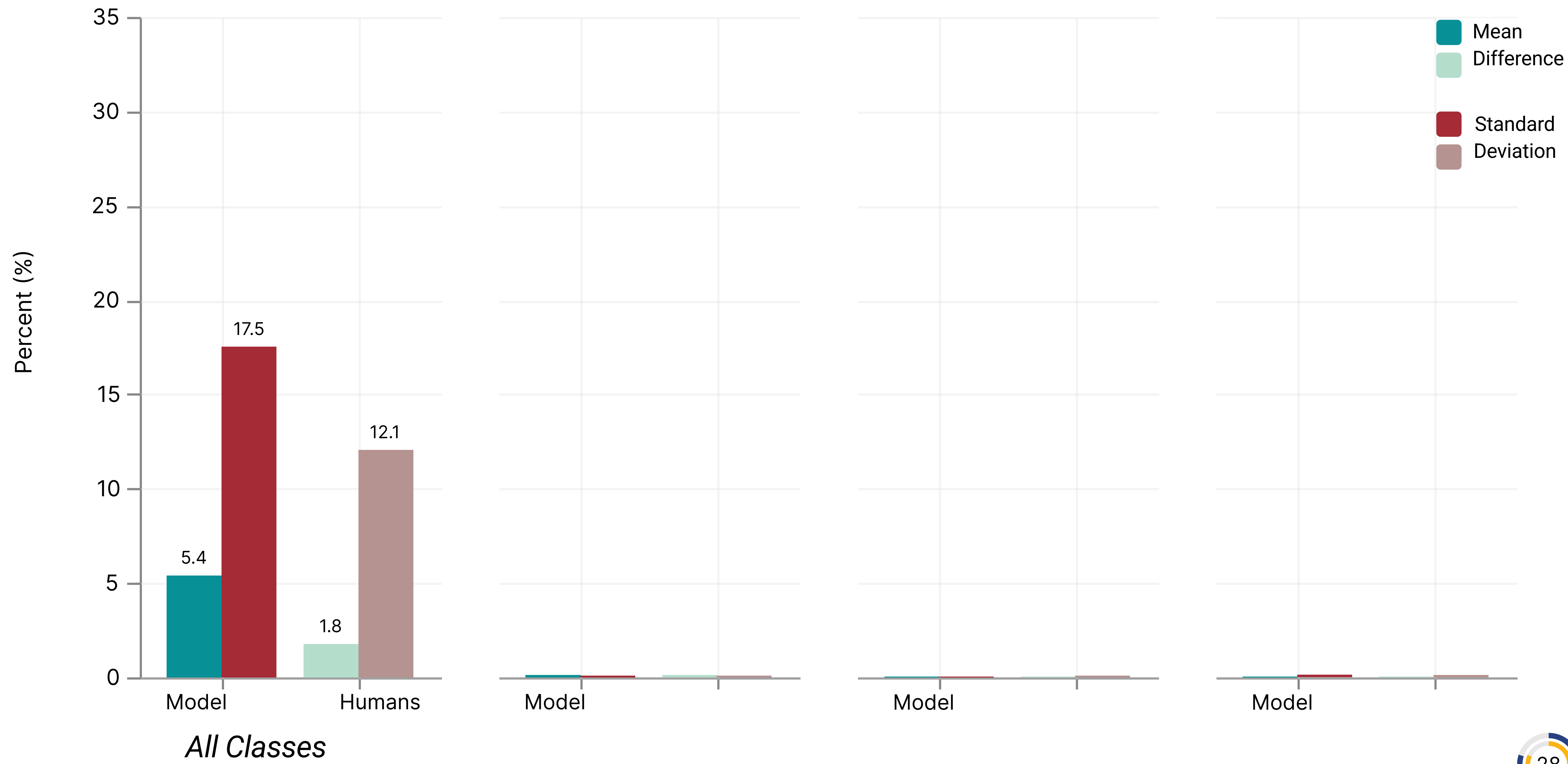


All Classes

Width Characterization Performance

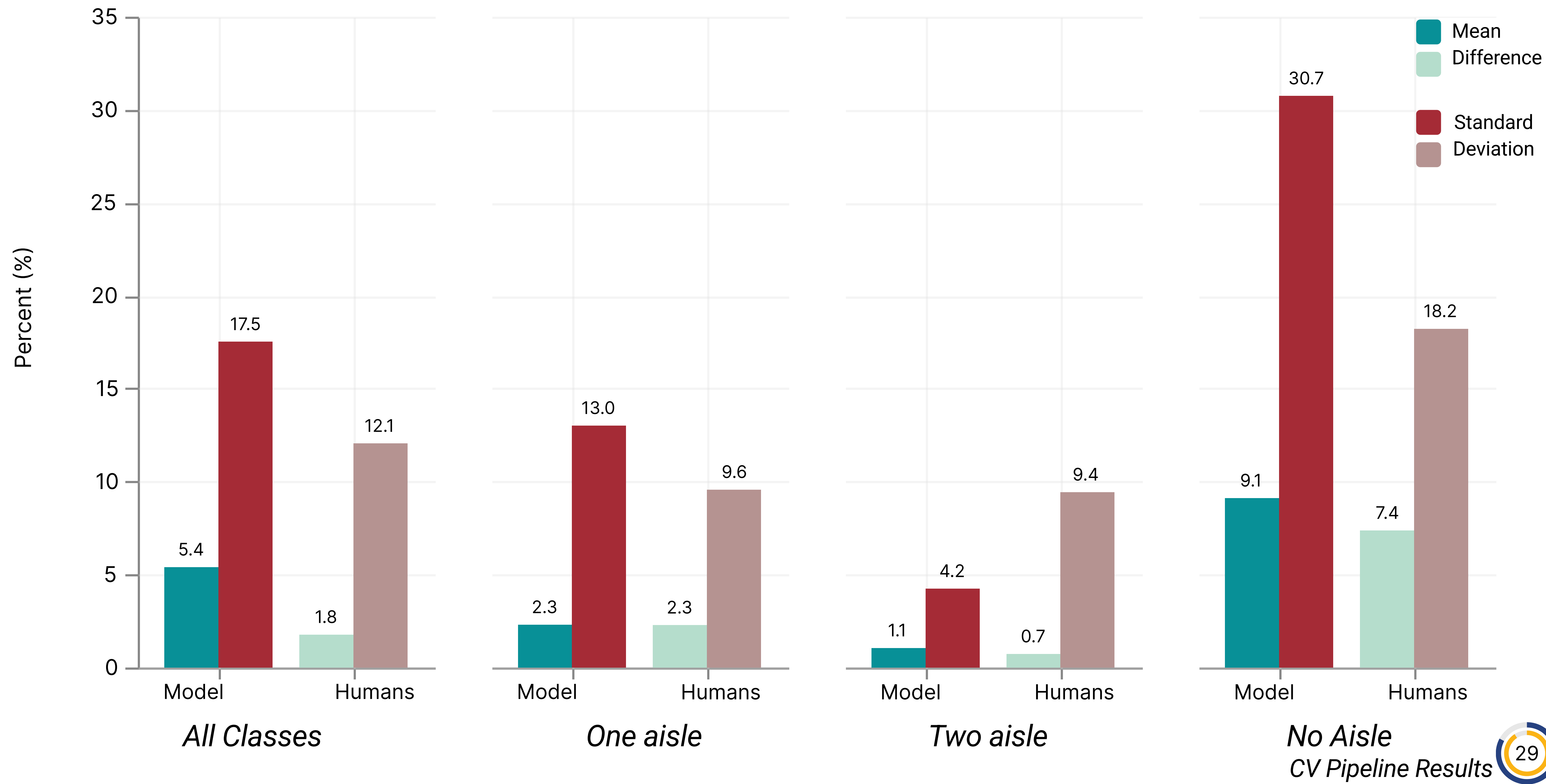


Width Characterization Performance



All Classes

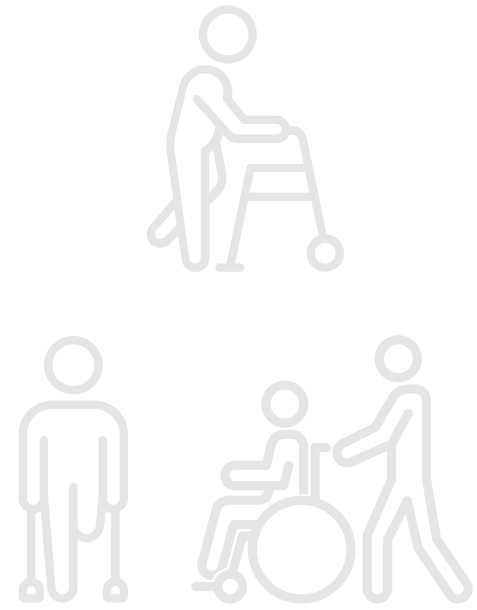
Width Characterization Performance





Needfinding

PwD Interviews
(N=11)



Orthorectified Tiles



Object Detection



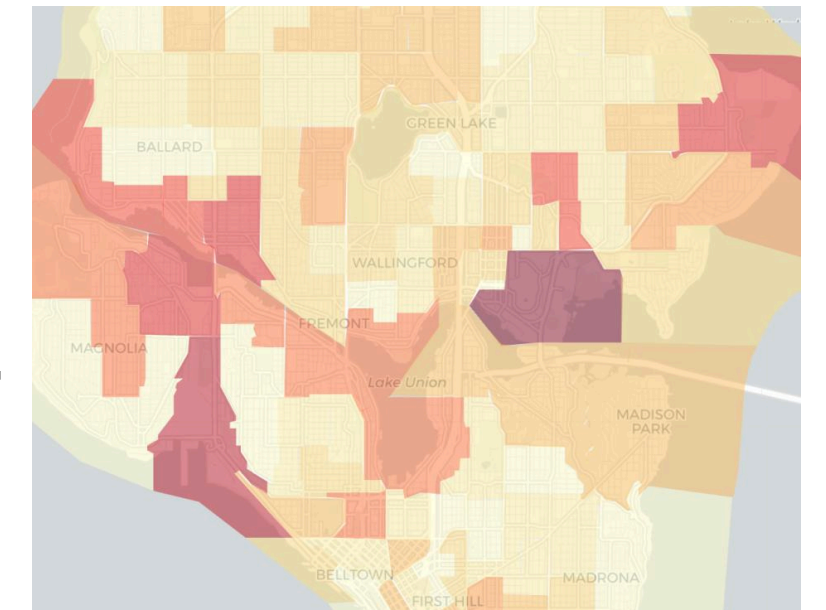
Oriented
Bounding Boxes



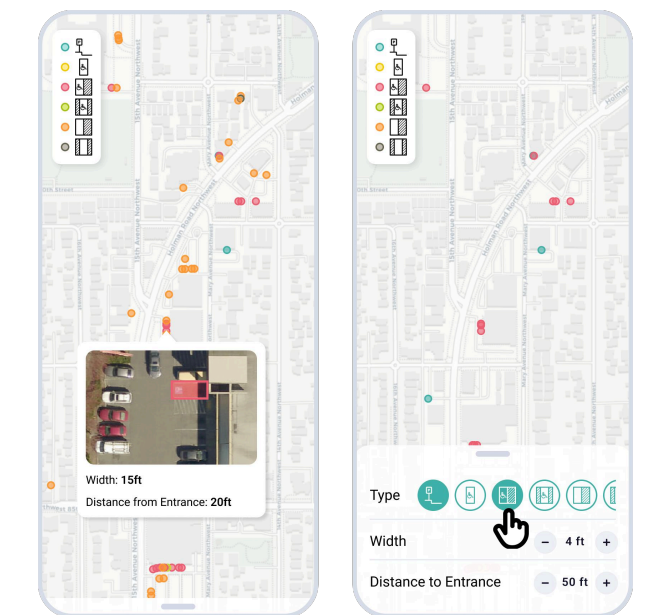
Completed Detections



New Applications



Disability Parking Analytics



Disability Parking App

Interview Study

*How do PwDs use
disability parking?*

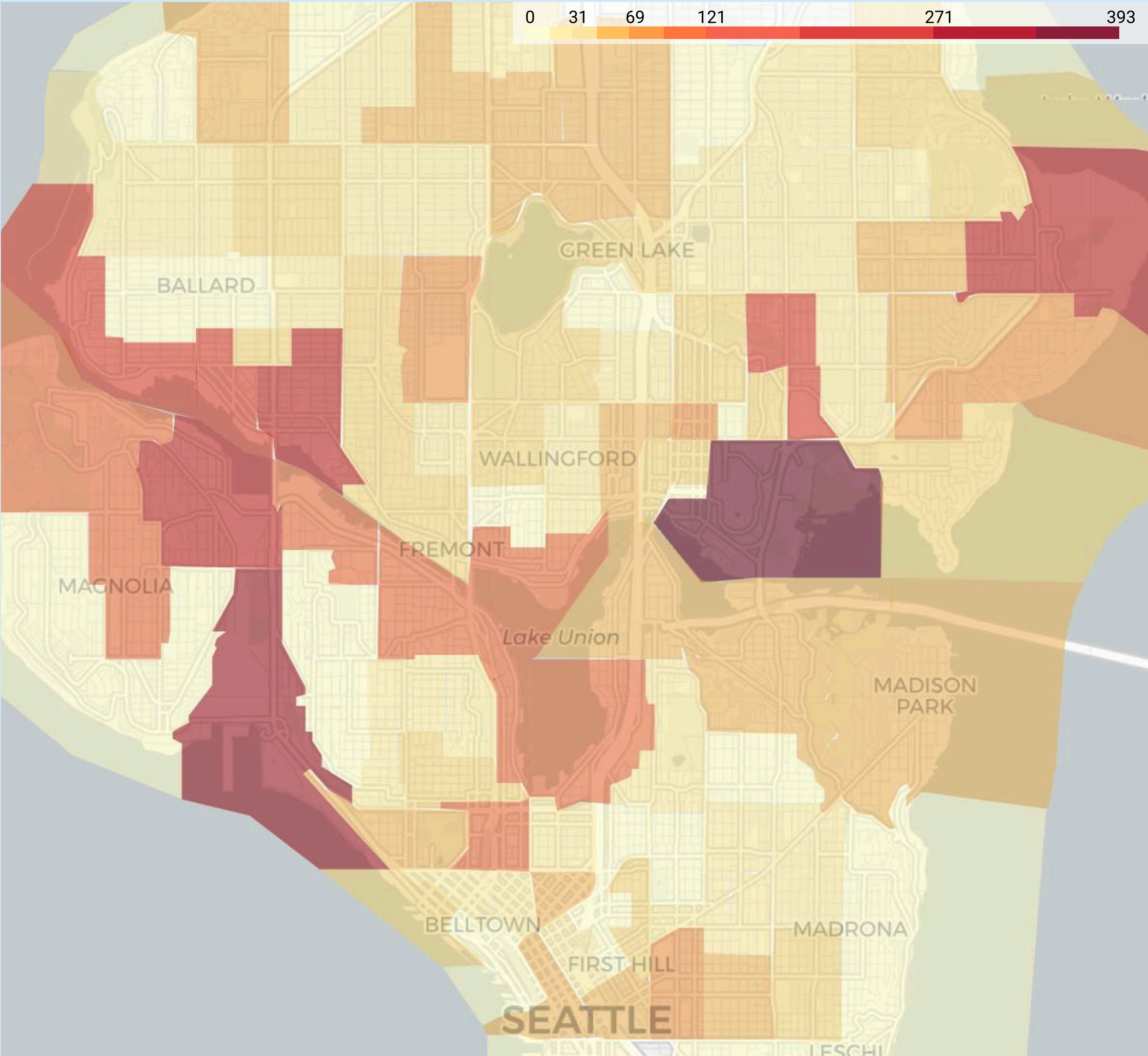
Dataset & Pipeline Development

*How well can CV models locate and characterize
disability parking from aerial imagery?*

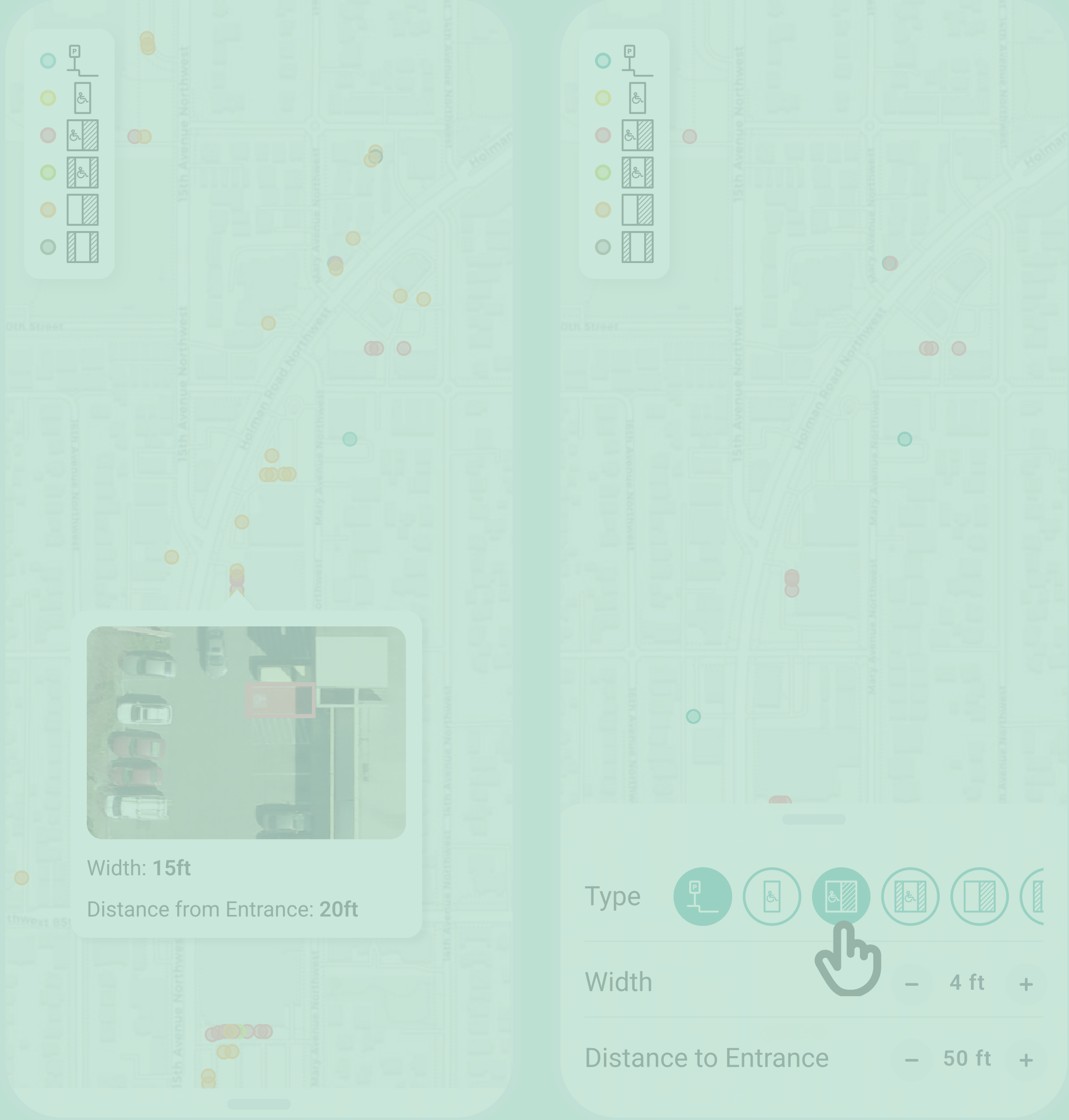
New Applications

*How could our CV model be used
to build useful technology tools?*

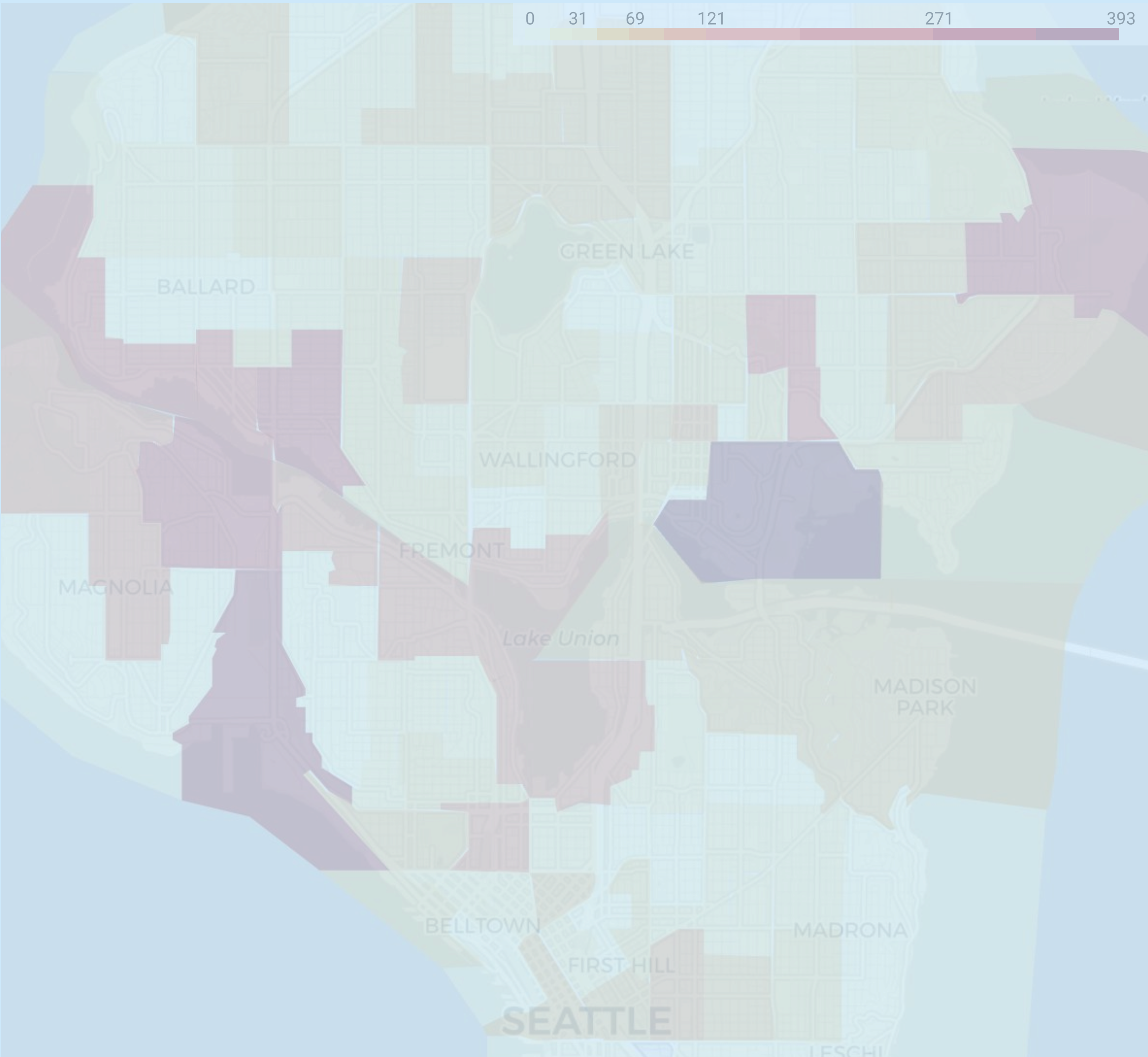
Policy Level



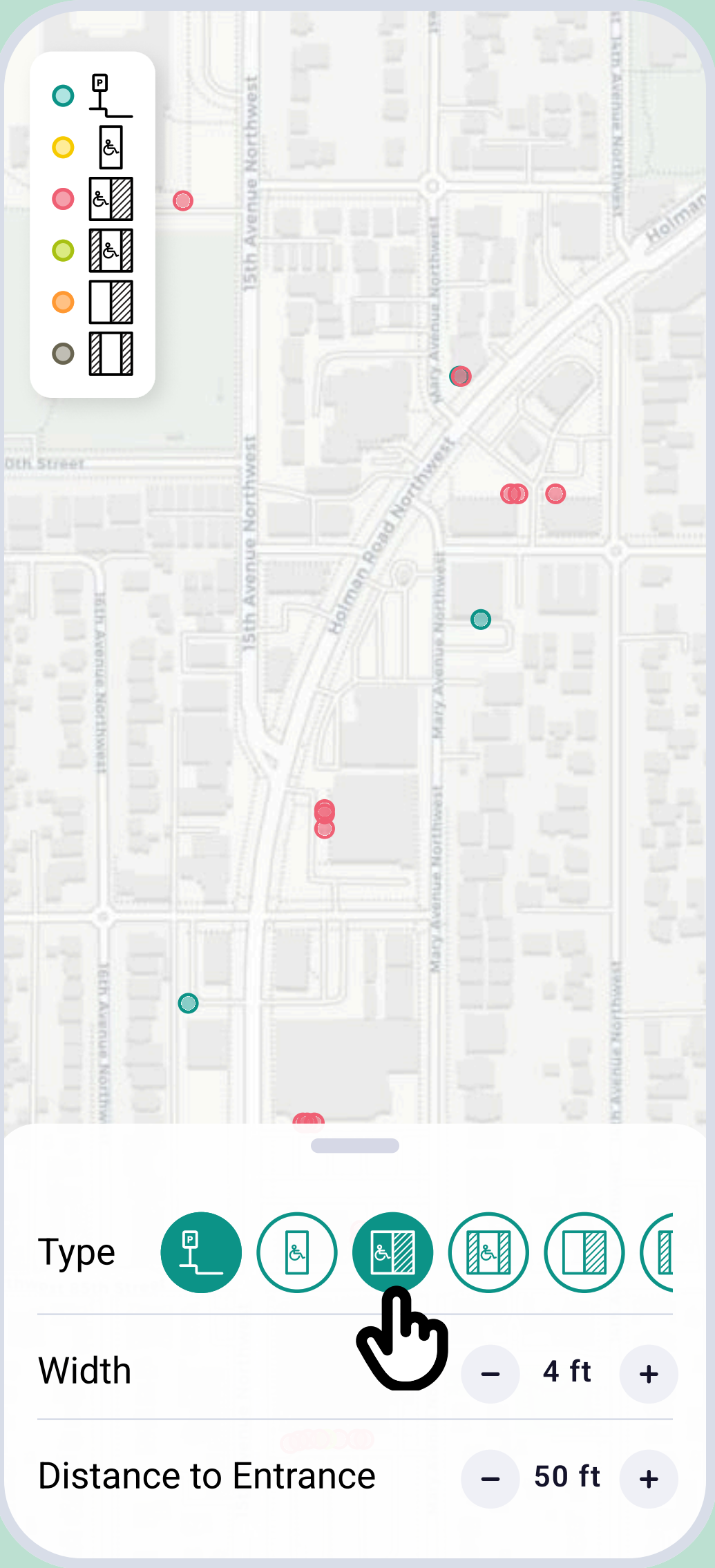
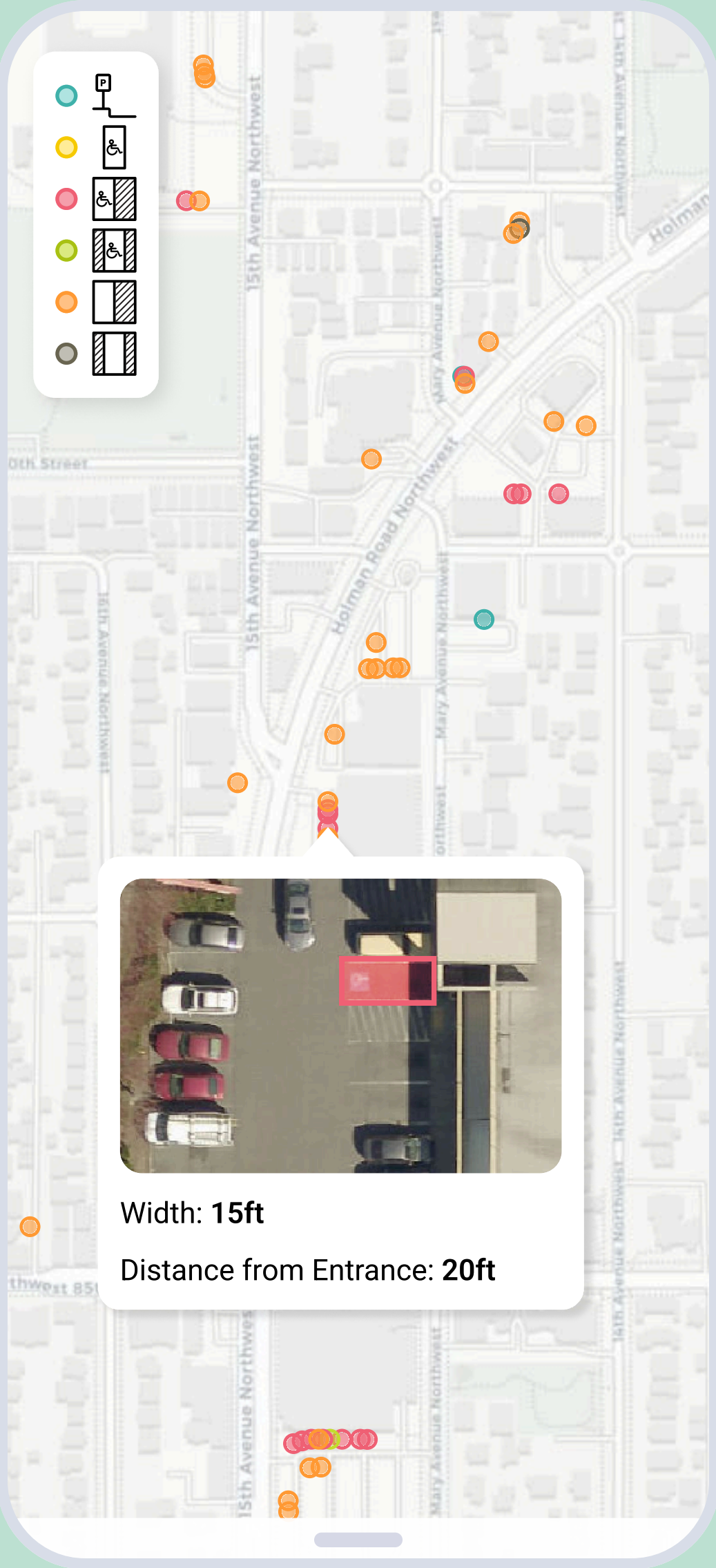
Individual Level



Policy Level

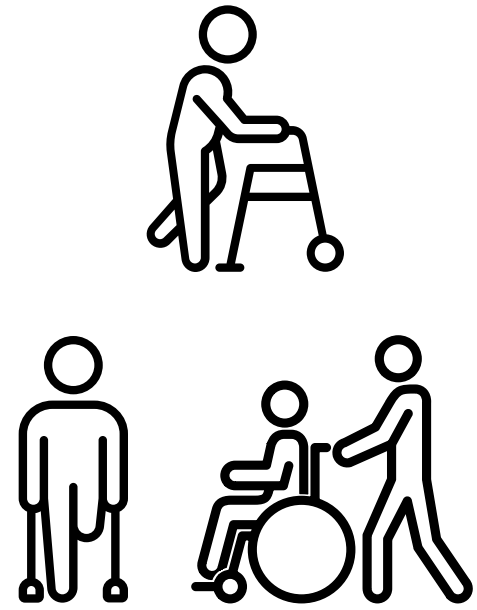


Individual Level



Needfinding

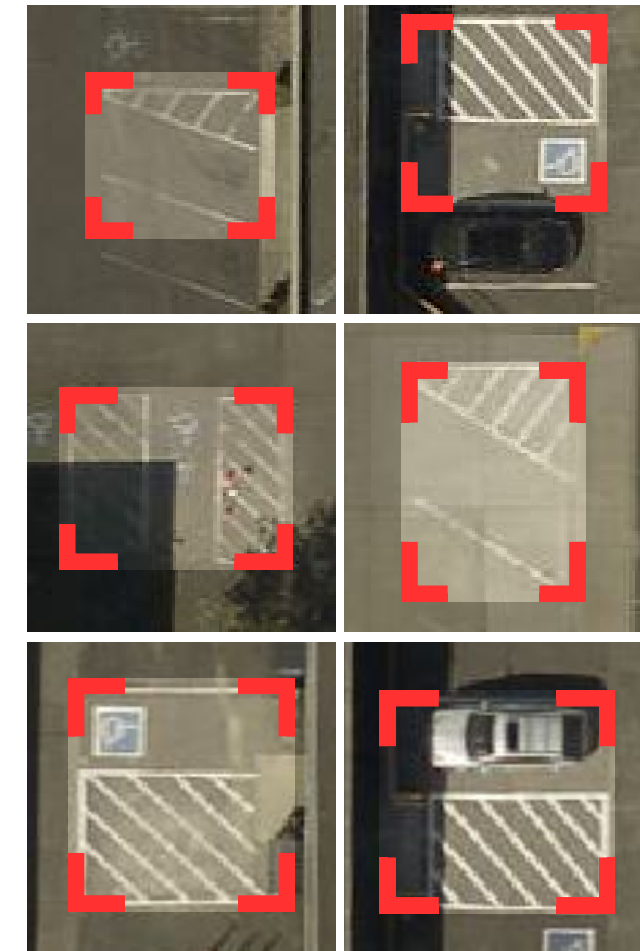
PwD Interviews
(N=11)



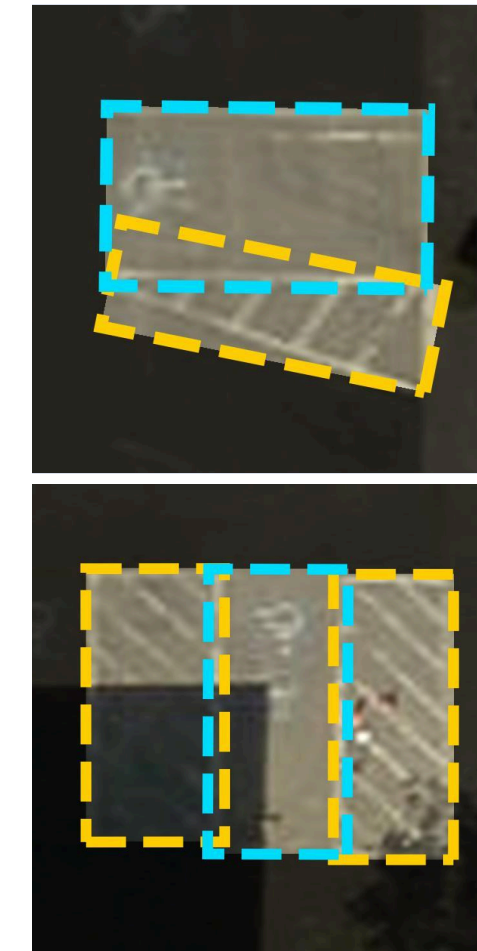
Orthorectified Tiles



Object Detection



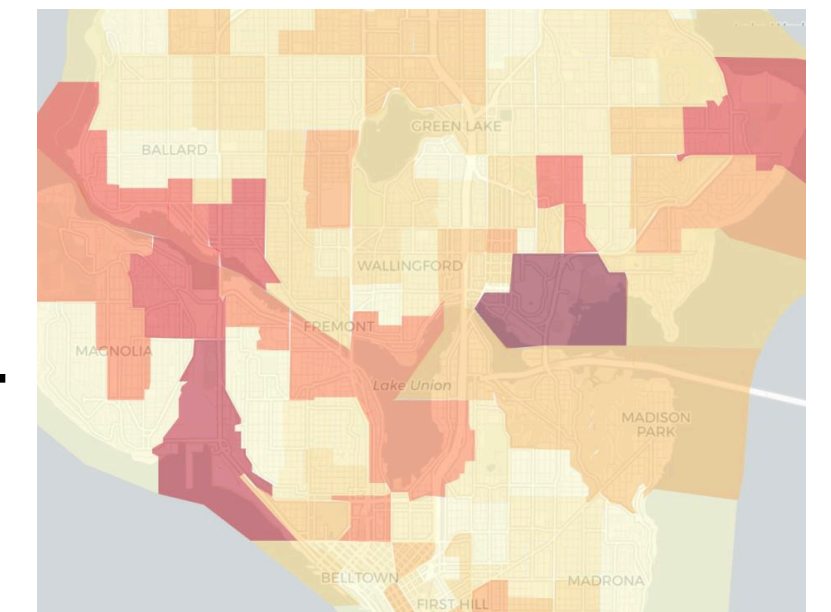
Oriented
Bounding Boxes



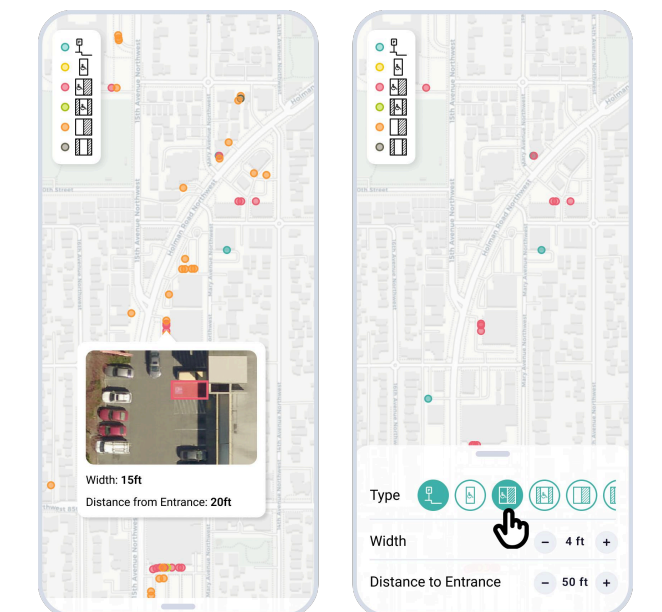
Completed Detections



New Applications



Disability Parking Analytics



Disability Parking App

Interview Study

→ Formative findings on how PwDs navigate disability parking, alongside policy recommendations

Dataset & Pipeline Development

→ An open-source dataset of 11,762 labeled disability parking objects

New Applications

→ A CV tool that locates, classifies, and characterizes disability parking from aerial imagery

Where Can / Park?

Understanding Human Perspectives and Scalably Detecting Disability Parking



**Jared
Hwang**
UW CSE



**Chu
Li**
UW CSE



**Hanbyul
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**Maryam
Hosseini**
UC Berkeley
City and Regional
Planning



**Jon E.
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UW CSE

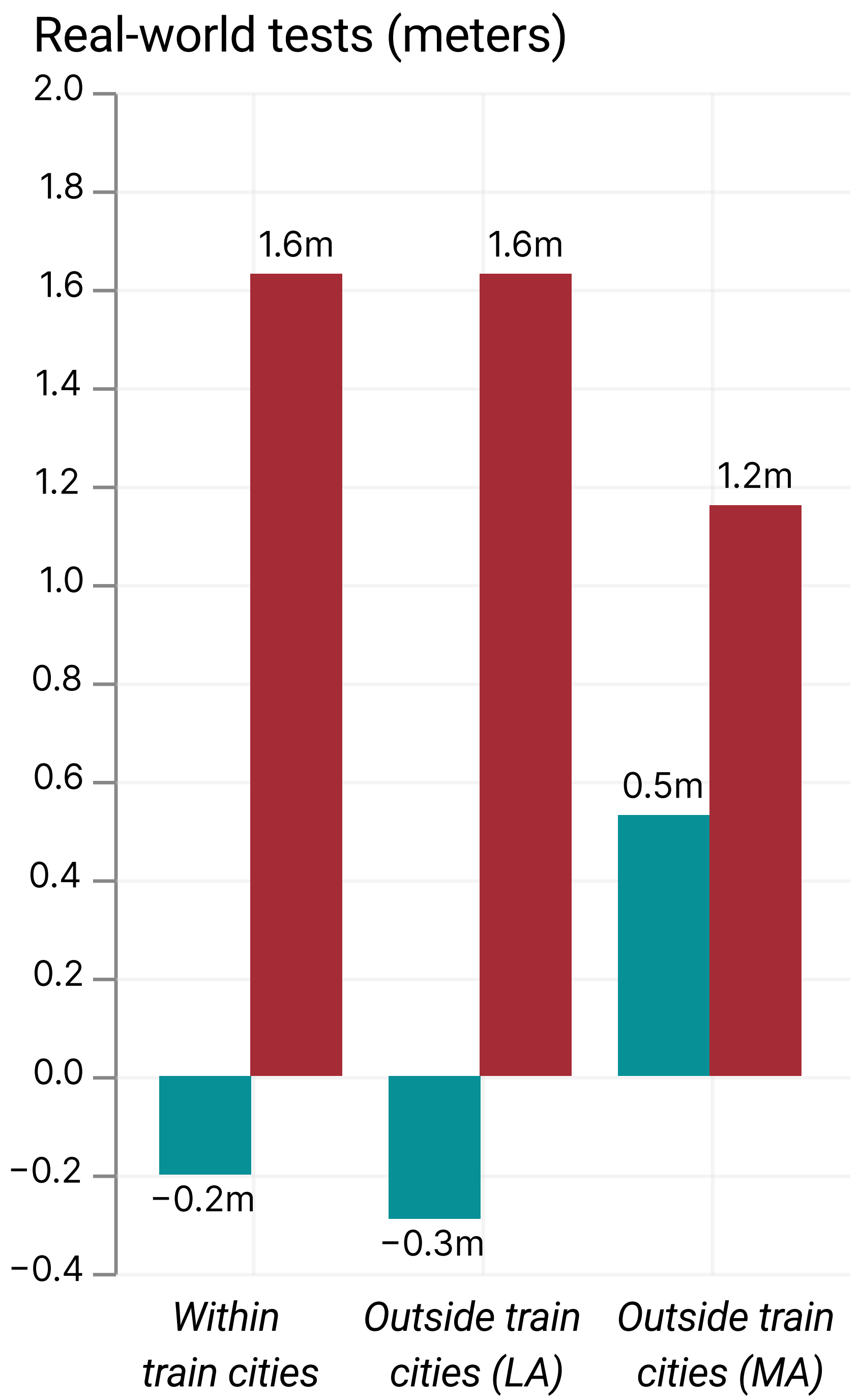
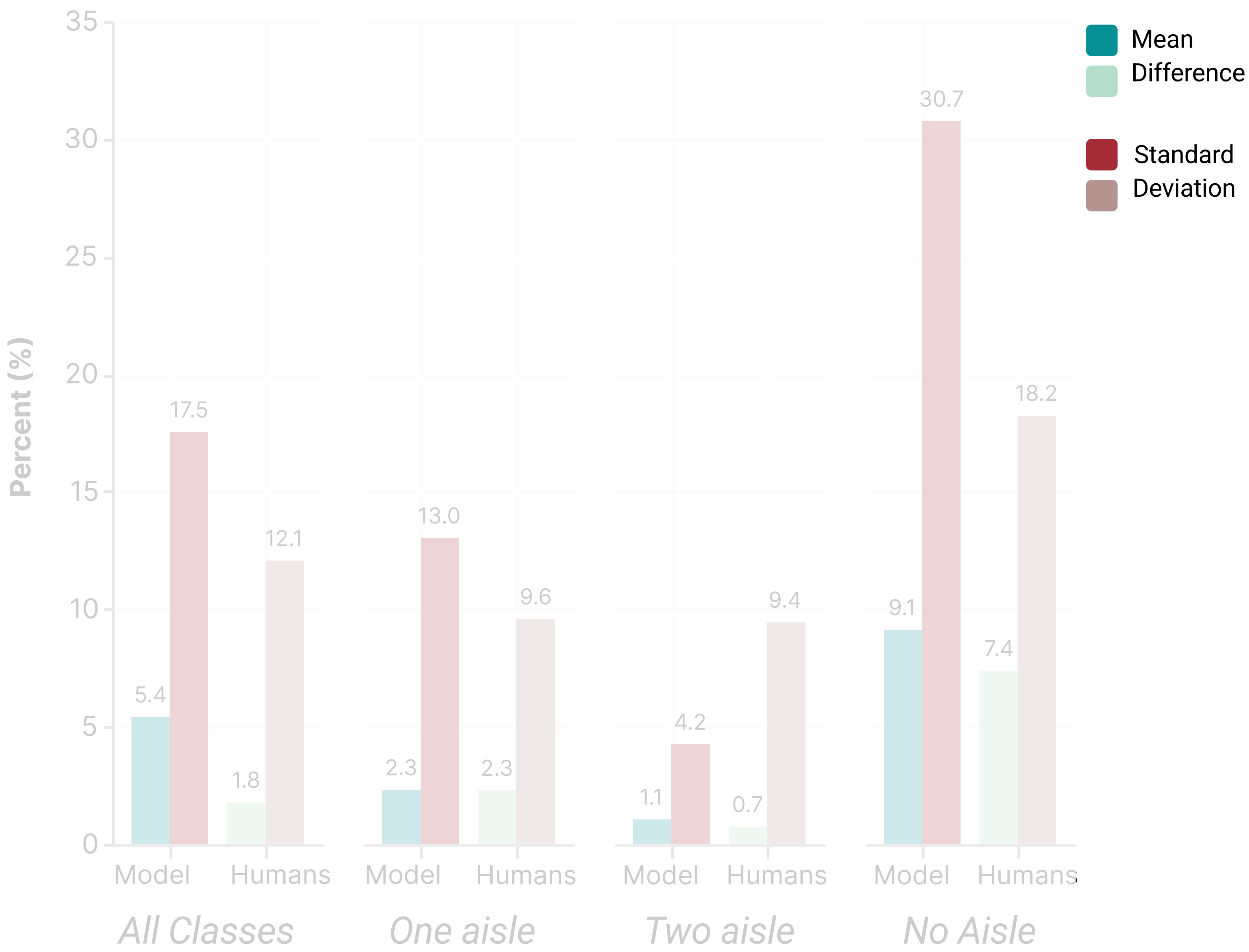
**Expert in ML
and Human+AI!**

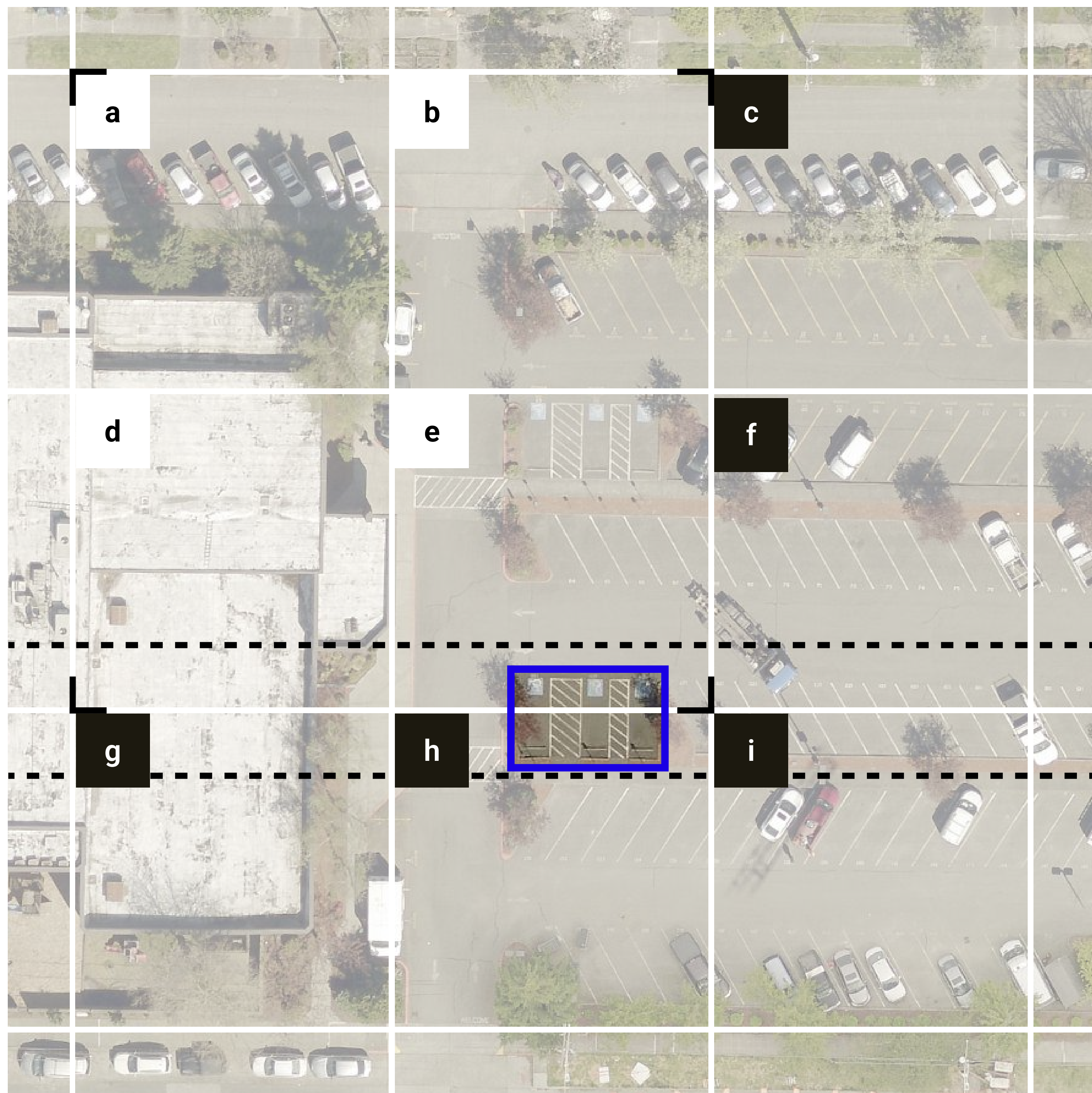
Looking for internships!



I am parked like this
because the wheelchair
parking spots were full, and
if anyone parks within
6½ feet of my car door
I can't get me & my wheelchair
into my car

Width Characterization Performance





Typical

Atypical

Detection

 curbside

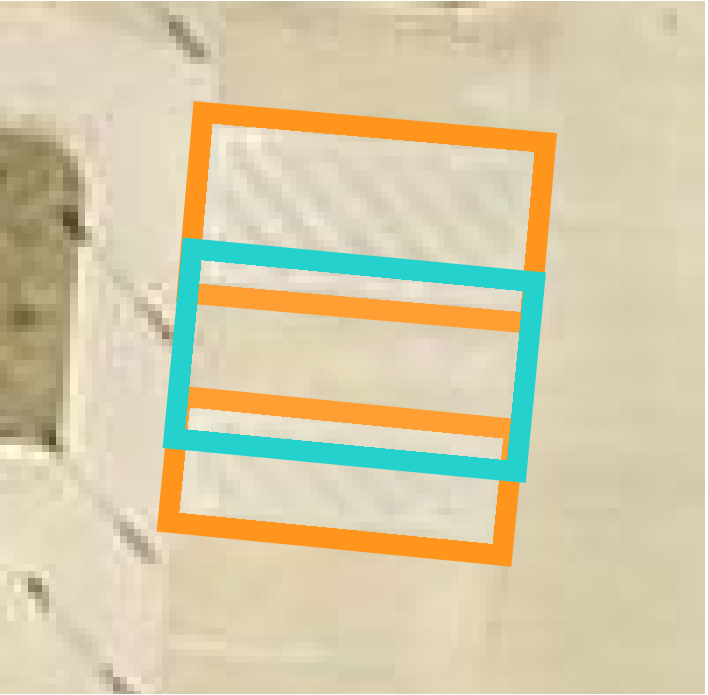
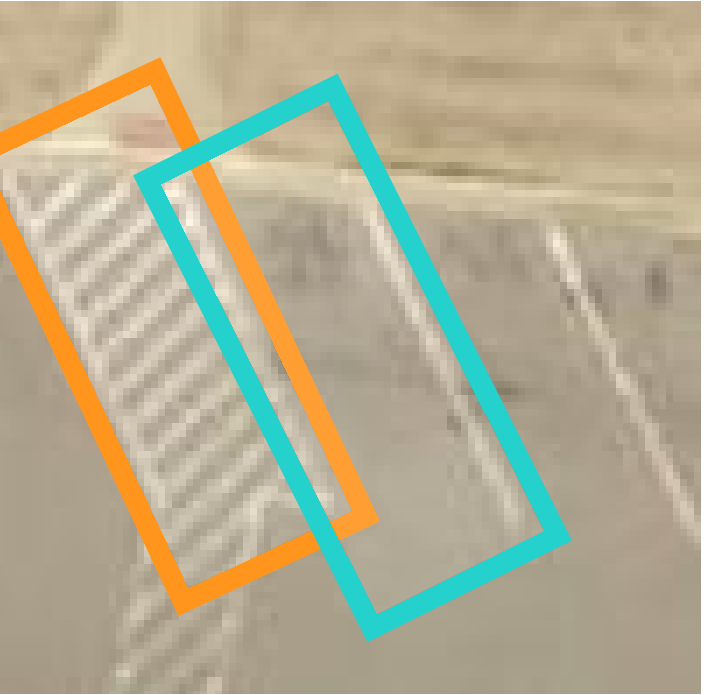
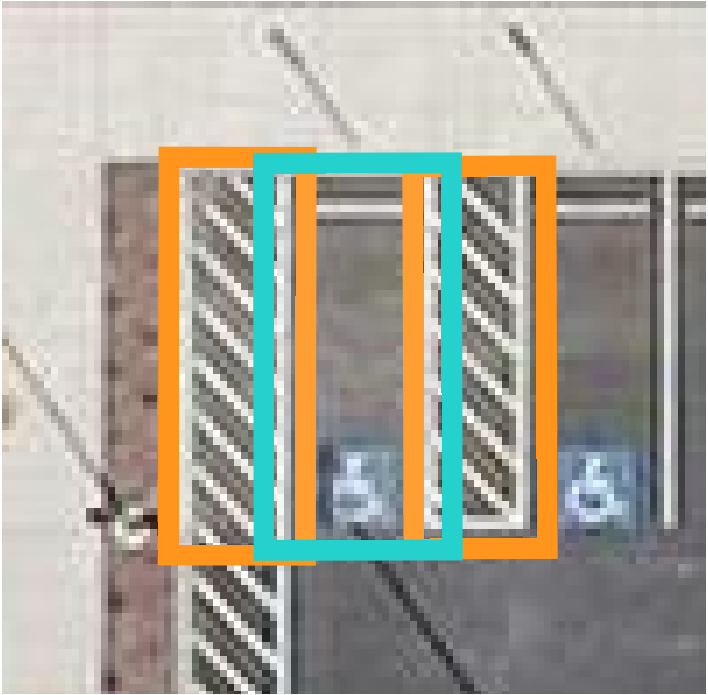
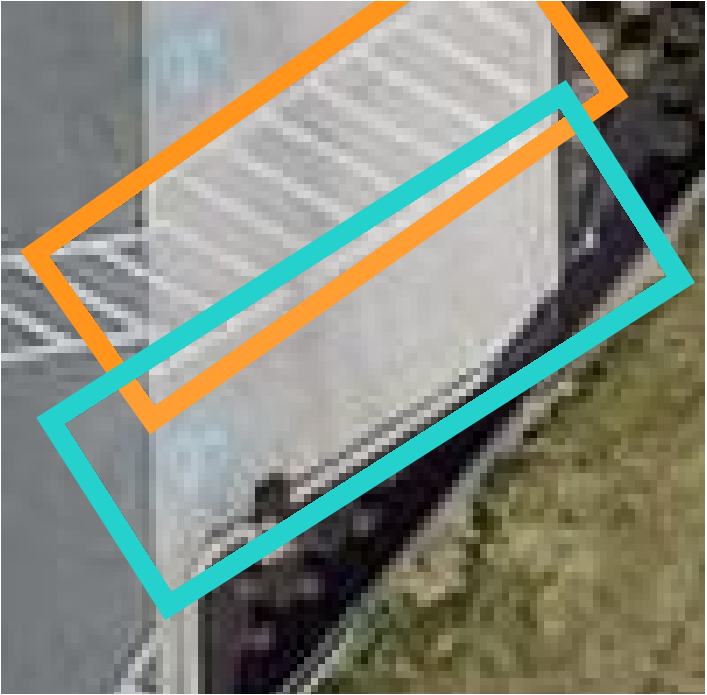
 dp_no_aisle

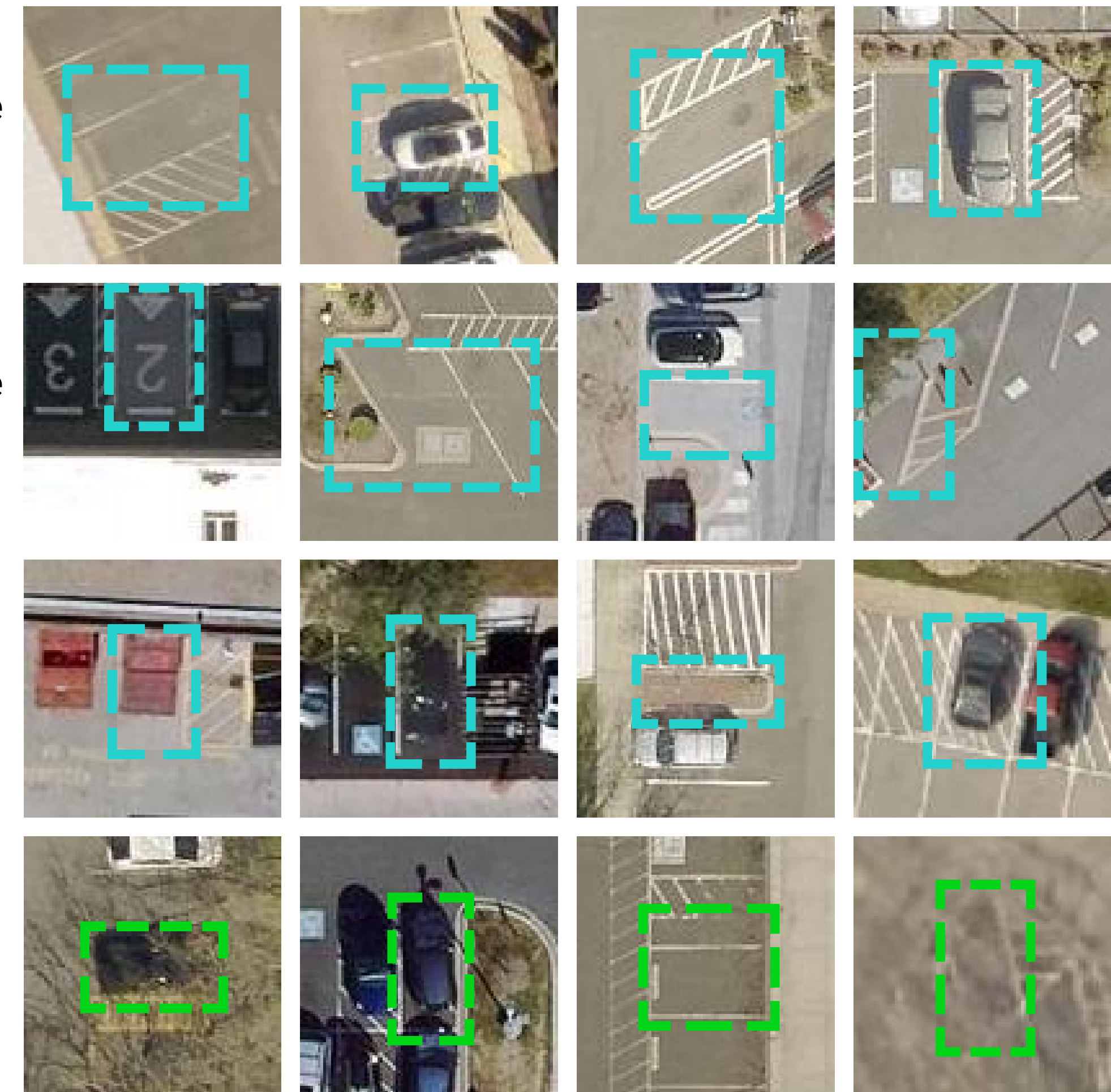
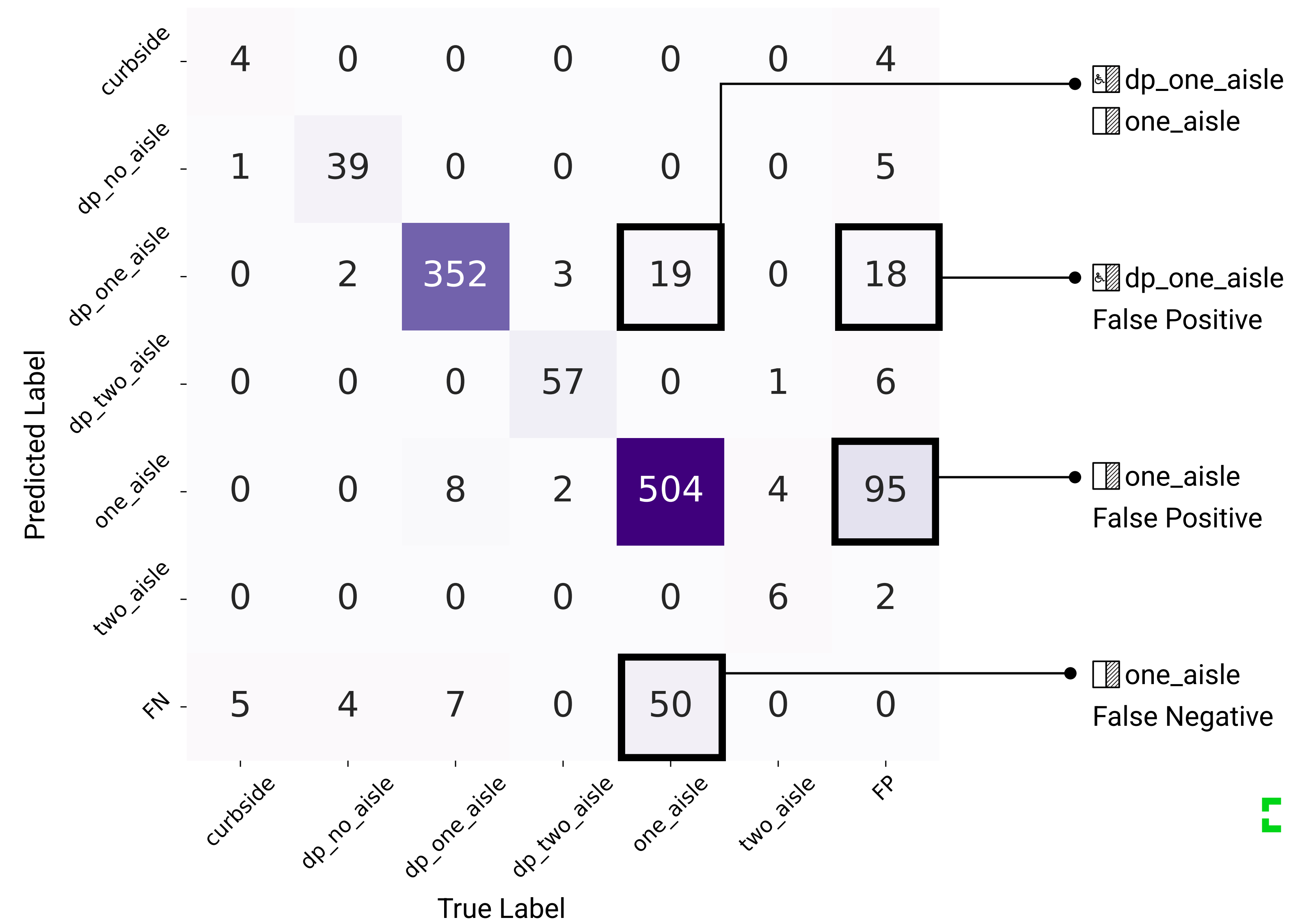
 dp_one_aisle

 dp_two_aisle

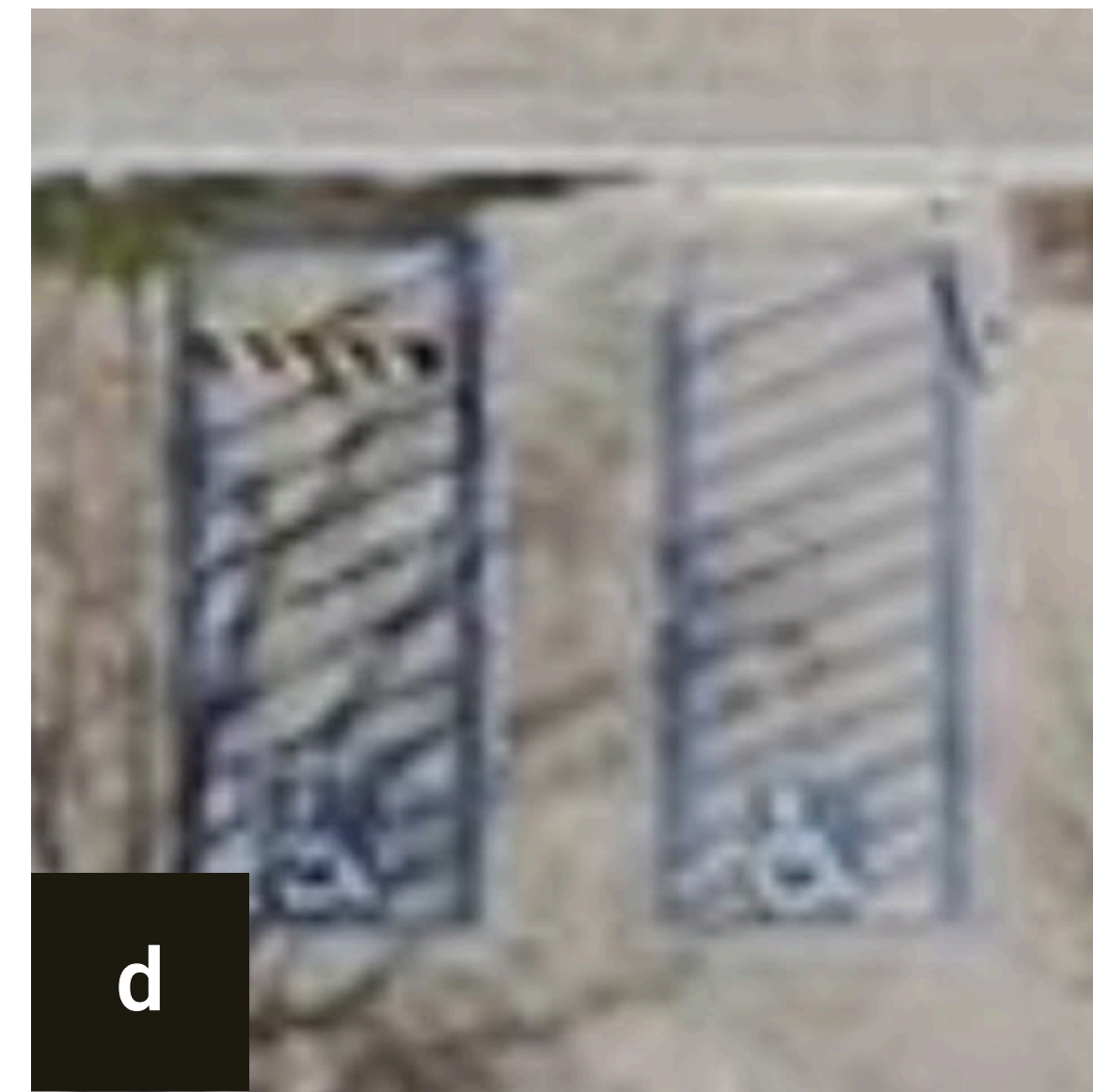
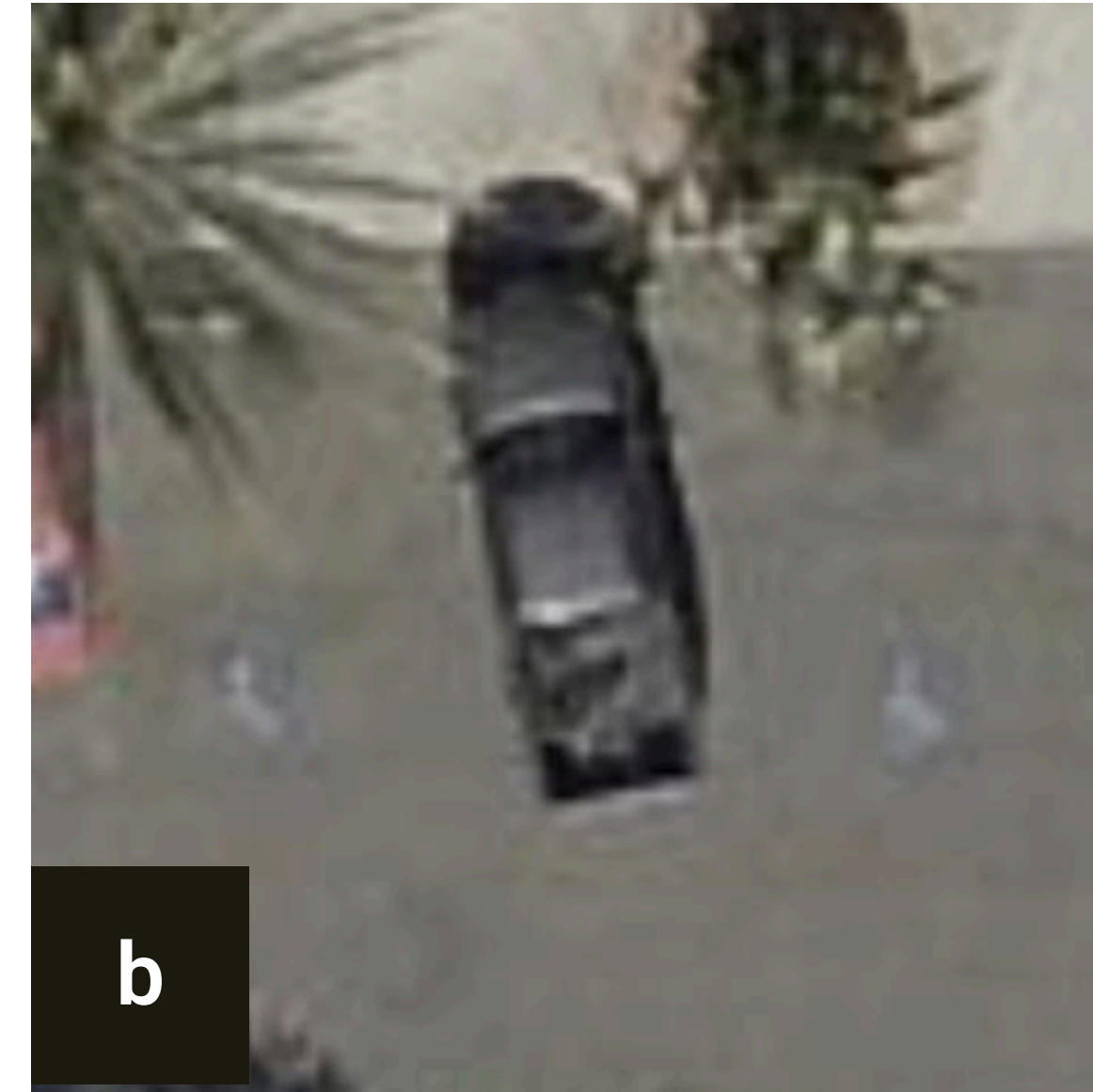
 one_aisle

 two_aisle

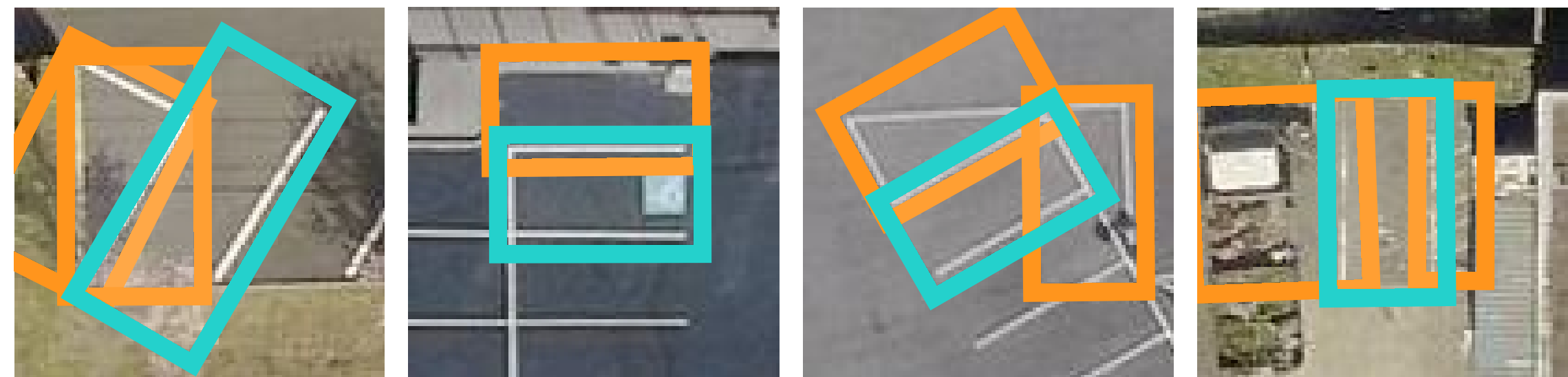
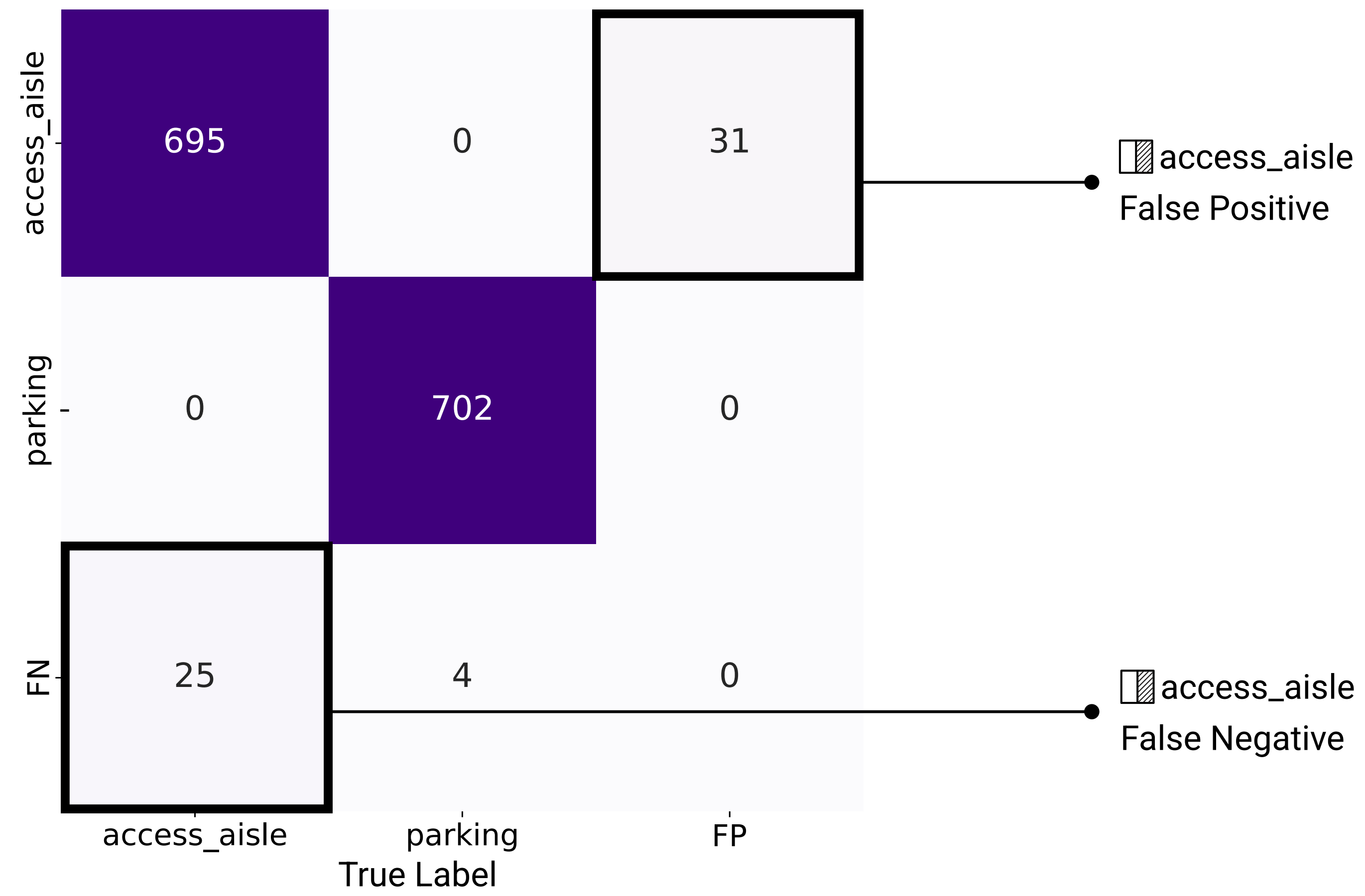




 ground truth parking bounding box
  predicted parking bounding box



Predicted Label



predicted parking predicted aisle

